FIELD CROP ABSTRACTS

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REVIEW ARTICLE

PLANT POPULATION AND CROP YIELD : PART I

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Introduction

In modern times, the establishment of the plant population in crops has been greatly facilitated by the use of better seed, control of pests and diseases and better or more timely preparation of seed beds resulting from the availability of mechanical power. These features have made many farmers reconsider seed rates for various crops and have focussed the attention of agronomists upon the fundamental relation existing between crop yield and plant population. The relation can be pictured graphically and it is important to know its shape as well as its degree of slope or curvature. This information is necessary in order to obtain value/cost ratios and thus establish the economic optimum of plant population.

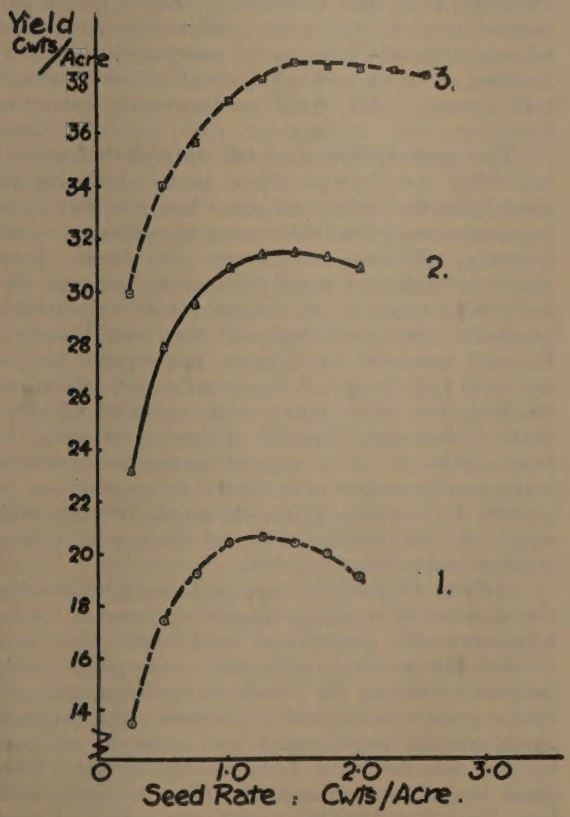

Fig. 1. Winter wheat : mean yield/seed rate curves. 1.=Boyd's data. 2.=All available data. 3.=All available data, less that from Boyd and NAAS, High Mowthorpe.

The author has suggested elsewhere (Holliday, 1960) that two quite distinct relations exist according to whether the yield in question is some product of the crop's growth in the reproductive phase or a product of growth in the vegetative phase. In the former case, as shown by Engledow (1926) and Hudson (1941) working with grain yield in wheat at Cambridge, the relation is approximately parabolic in shape as shown in Fig. 1. Hudson showed that the curve was typically a flat-topped one with only small decreases in yield at both sides of the optimum. He also showed that the curves could be fitted by the quadratic regression

$$y = a + bx - cx^2$$

where y = yield per unit area, x = plant population and a, b and c = the regression constants.

Since Engledow's time work has been carried out on other crops where yield is similarly a function of reproductive growth. These have included maize (Krantz, 1949), soyabean (Weiss, 1949), peas (Reynolds, 1950), tomatoes (Cooper, 1957), seed cotton (Crowther and Mahmoud, 1935, 1937), hops (Keller, 1949) and seed yield in Wimmera ryegrass and subterranean clover (Donald, 1954). In each case the yield/plant population relation has been a flat-topped parabolic type of curve similar to those of Engledow and Hudson.

The second type of relation between yield and plant population would appear to be asymptotic in shape (see Fig. 2 overleaf) and is characteristic of yields which are some product of growth in the vegetative phase. This relation was obtained by the author in the case of dry matter yields in the rape crop (Holliday, 1960). Similar results were also obtained at Leeds University with both marrow-stemmed and thousand-headed kale (Roebuck, 1959) and total tuber yield of potatoes (Saunt, 1960). Such widely differing crop forms as timber yield of slash pine in the USA (Barns and Ralston, 1955) and leaf yield of Wimmera ryegrass and subterranean clover in Australia (Donald, 1951) have given similar relations. Donald's work is of particular interest, as in the same experiments the seed-

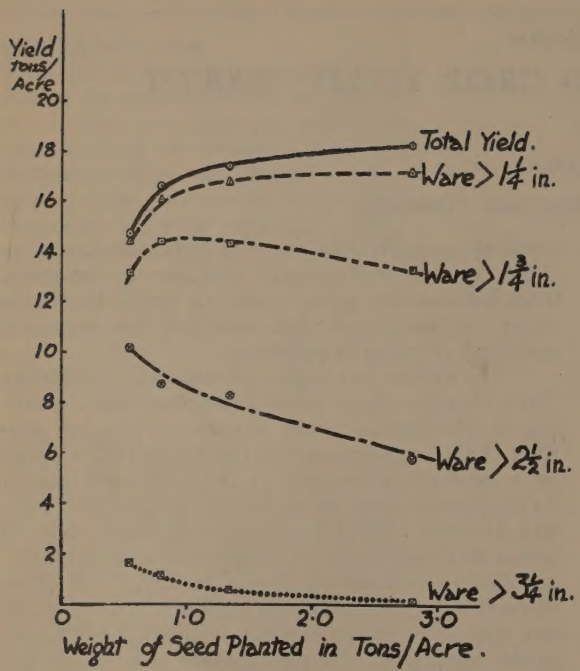

Fig. 2. Potatoes : weight of seed planted/total yield and ware yields. (After Davies, 1954)

yield relation was of the one type and the leaf-yield of the other. A second feature of interest was the range of populations covered. In the case of Wimmera ryegrass, populations up to 180×10^6 plants per acre were used. This population range is far greater than that covered by any other worker.

The author has suggested elsewhere (Holliday, 1960) that this second form of yield/plant population relation can be defined by the expression

$$y = Ax. \frac{1}{1 + Abx}$$

where y = yield of dry matter per unit area, A = the " apparent " maximum yield per plant, x = number of plants per unit area, b = the linear regression coefficient of the reciprocal of yield per plant and plant population. In this expression, the term $1/(1 + Abx)$ represents the manner in which the maximum plant yield (A) is reduced by the increasing competition resulting from greater plant density. In consequence it may be termed the " competition function ". It is to be noted that $1/x$ is a measure of the area available per plant and that the environment resources are available to the plant on an area basis.

There is contradictory evidence in the literature as to whether an increase in the environment resources would justify greater plant populations or whether the greater size per individual plant permitted by increased resources would mean the maximum yield being reached at a lower population. On the whole, the evidence for the parabolic type of relation suggests either no interaction between population and environment resources, as for example in the case of soyabeans (Weiss, 1949), or a positive interaction as suggested by Hudson for wheat (Hudson, 1941) or by Krantz for maize (Krantz, 1949). On the other hand, the second relation implies that where A increases as a result of increased environment resources, the asymptote is reached at a lower population. Donald's work with Wimmera ryegrass and the work at Leeds University with kale and rape lend some support to this hypothesis. It should be mentioned, however, that if competition resulting from increased plant density restricts the depth of root penetration there will be a reduction in the quantity of water which can be absorbed from the soil profile. Thus the quantity of this environment resource may be effectively smaller at high plant populations. In this connection it should be noted that both Donald's work and the work at Leeds University quoted were both carried out under conditions where soil moisture was comparatively non-limiting. The expression derived for the asymptotic curve implies fixed environment resources.

The population and its establishment

With some crops there is no difficulty in identifying the individual plant however dense the population may be. With most gramineous crops, however, tillering complicates the issue. Soon after establishment these tillers interlace and the individual plant is no longer identifiable unless quadrate areas are lifted and they are dissected. In such cases the yield/plant population has to be stated in terms of the number of plants at establishment or in terms of the number of tiller units at harvest. Neither of these expressions is very satisfactory. A somewhat similar situation exists in the potato crop where the population is strictly the number of sprouts which develop, and which, on the decomposition of the parent tuber, become independent plants.

When the seed is sown and has germinated, the number of seedlings appearing bears a linear relation to the quantity of seed sown (Holliday, 1953). At a very early stage interplant competition results in the death of seedlings, and, as this is greater at higher populations, the original linear relation is converted into a curved relation by the time the crop becomes established. This plant loss often continues, though at a diminished rate, throughout the life of the crop. Any adverse growth factor increases the rate of loss. With the gramineous crops, increased tillering at the lower plant populations is an additional cause of curvature in the graphic relation between seed sown

and tiller population produced. The slope of the initial linear relation and the degree of curvature of the subsequent relation varies very much with environment.

All this means that the number or weight of seed sown per unit area is a very unreliable guide to the final number of plants at harvest time. Unfortunately, in many cases in the work on individual crops reviewed below, insufficient data on the actual population is given. In some cases the only guide to the population is the quantity of seed sown. Whilst this represents one of the farmer's cash inputs in producing the crop, its final relation to yield is via firstly the population established, secondly the population surviving and thirdly the intrinsic effect of the final population.

Yield and plant population in British crops

1. CEREAL CROPS

Reference has already been made to the work of Engledow and Hudson on winter wheat at Cambridge. As well as showing the form of the yield/population relation (Engledow, 1926 ; Hudson, 1941), they examined various yield components such as the number of plants established from the seed sown, the number of vegetative and fertile tillers per plant, together with the number and weight of seed per ear. They showed that each of these yield components decreased with increasing density. More recently Boyd (1952) summarised all the available trial data published since 1900 on seed rates and yield of wheat, barley and oats. This summary included the results of many simple trials carried out in different parts of the country before Engledow's time, as well as data from more recent trials, notably those from Jealott's Hill (1935), Rothamsted (1946–1950) and some of the earlier work of the National Agricultural Advisory Service (NAAS, 1950). In the summary Boyd plotted graphically the results of all these experiments. Using interpolated values where necessary, the average yields were calculated at intervals of half-bushel (wheat and barley) or one bushel (oats) at both sides of a standard sowing rate of 2 bushels per acre. This gave, for each cereal crop, average seed rate/yield curves which were of the flat-topped parabolic type referred to above. The curve for oats showed less curvature than those for barley and wheat. The points of inversion in these curves were at lower seed rates than those normally used in the case of wheat and barley. Since Boyd's review there has been a number of other results published from NAAS experiment programmes and also from the Norfolk Agricultural Station, Sprowston. Several of these have examined the influence of other factors upon the seed rate/yield relation. Boyd's data and the data from these later experiments, together with some previously unpublished data from Leeds University, are brought together in Table 1 (overleaf).

It will be seen from Table 1 that the point of inversion in the yield response curves (marked in heavy type), so far as it can be ascertained, varies considerably in the various data. It should be noted that each item is itself the mean of several experiments at different sites or in different years. An examination of the individual experiments shows even wider variation. For instance, in the data of Bullen and Scragg (1958), the maximum yield was attained with 1·0 cwt. of seed in 4 out of 8 experiments ; in the winter wheat data from Leeds University the maximum was at 1·0 cwt. in 2 years, and, in 1 year, between 1·0 and 2·0 cwt. of seed per acre ; in the spring wheat data from Leeds University the maximum yield was at 1·0 cwt. of seed per acre in 2 years but at 4 cwt. per acre in 1957.

In Table 2 (overleaf) information is given on seed rate, actual plant population and fertile tiller population at the point of maximum yield in experiments where such data were recorded. It is evident that some of the differences in seed rates giving maximum yields can be attributed to differences in the plant population established from the weight of seed sown. This in turn will be affected by the date of sowing and the seed-bed tilth. The former was shown to be the case in the experiments carried out in the West Midland Province (NAAS, 1950). The relation between the plant population and the maximum yield is still not a close one, however. On the other hand there would seem to be a closer relation between the fertile tiller population and the maximum yield. Approximately 1·2 million fertile tillers per acre seem to give the maximum yield for winter wheat, with a rather higher figure for spring wheat. The single item of data for barley in Table 2, however, shows the fertile tiller population at maximum yield is considerably greater. Glynne and Slope also obtained higher fertile tiller populations at the yield maximum with barley (i.e. 3·13 millions in 1954 and 2·95 in 1955). The relation between fertile tiller population and maximum yield may have some significance in view of the fact that ear photosynthesis can account for 25–30% of grain yield (Archbold and Mukerjee, 1942). In Table 1 data for the "coefficient of multiplication" (yield ÷ seed weight) is also given. The seed rate used and the final yield both have considerable effects upon the coefficient. Further comments on this are given later.

Several of the more recent experiments have incorporated fertiliser nitrogen as a treatment factor. Table 3 (overleaf) summarises some of this data. It will be noted that with winter wheat, the data from Leeds University, Bullen and Scragg, Jackson and Page (at the low level of nitrogen), as well as some of the Rothamsted and Jealott's Hill experiments previously reviewed by Boyd, all show some evidence of a positive interaction between seed

Table 1. Cereals : data on seed rate and crop yield

(s = seed rate in cwt./acre, y = grain yield in cwt./acre)

Winter Wheat

Boyd, 1952 (mean of 14 expts)				Jackson and Page, 1957 (mean of 6 expts)				Leeds University, 1960 (mean of 5 yr.)				Whybrew, 1958 (mean of 4 yr.)			
s	y	y/s	s/y	s	y	y/s	s/y	s	y	y/s	s/y	s	y	y/s	s/y
0·8	19·5	24·3	0·0412	1·1	40·8	37·1	0·0270	0·5	28·6	57·2	0·0175	0·7	**42·9**	60·3	0·0166
1·1	**20·5**	18·7	0·0535	1·7	41·8	24·6	0·0407	1·0	33·3	33·3	0·0300	1·4	42·7	30·5	0·0328
1·4	**20·5**	14·7	0·0683	2·2	42·6	19·4	0·0513	2·0	**38·7**	19·4	0·0515	2·1	41·0	19·5	0·0513
1·7	19·9	11·7	0·0855	2·8	**43·1**	15·4	0·0650	4·0	36·7	9·2	0·1086				
2·0	19·0	9·5	0·1050												

Bullen and Scragg, 1958 (mean of 8 expts)				NAAS, High Mowthorpe, 1960 (mean of 4 yr.)				Harvey and Shepherd, 1958 (mean of 3 yr.)			
s	y	y/s	s/y	s	y	y/s	s/y	s	y	y/s	s/y
0·5	30·3	60·6	0·0165	1·1	**26·4**	24·0	0·0470	0·7	**36·0**	51·5	0·0196
1·0	34·8	34·8	0·0290	2·2	25·7	11·7	0·0855	1·4	35·8	25·6	0·0391
1·5	**35·6**	23·7	0·0422					2·1	35·1	16·7	0·0600

Spring Wheat

NAAS, W. Midland Province, 1950–1 (mean of 2 yr.)				Harvey and Shepherd, 1958 (mean of 3 yr.)				NAAS, High Mowthorpe, 1960				Leeds University, 1960 (mean of 3 yr.)			
s	y	y/s	s/y	s	y	y/s	s/y	s	y	y/s	s/y	s	y	y/s	s/y
1·0	26·6	26·6	0·0376	0·7	34·9	49·8	0·0201	1·3	20·5	15·8	0·0634	0·5	21·0	42·0	0·0238
1·5	28·8	19·2	0·0520	1·4	**37·2**	24·5	0·0408	1·9	**21·2**	11·1	0·0900	1·0	**23·3**	23·3	0·0429
1·75	**29·8**	17·0	0·0590	2·1	35·0	16·7	0·0600	2·5	21·1	8·4	0·1190	2·0	22·6	11·3	0·0885
												4·0	20·1	5·0	0·2000

Spring Barley

Boyd, 1952 (mean of 16 expts)				Rennie, 1957 (mean of 3 yr.)				Jackson and Page, 1957 (mean of 9 expts)				Glynne and Slope, 1957 (mean of 2 yr.)			
s	y	y/s	s/y	s	y	y/s	s/y	s	y	y/s	s/y	s	y	y/s	s/y
0·5	18·5	37·0	0·0270	1·0	**27·9**	27·9	0·0364	1·0	31·3	31·3	0·0320	0·5	40·8	81·6	0·0123
								1·5	31·7	21·1	0·0474				
1·0	**20·5**	20·5	0·0488	1·5	27·7	18·5	0·0541	2·0	31·8	15·9	0·0630	1·0	**42·5**	42·5	0·0236
2·0	19·1	9·6	0·1043	2·0	27·6	13·8	0·0725	2·5	**32·1**	12·8	0·0783	1·5	42·4	28·4	0·0354

Spring Oats

Boyd, 1952 (mean of 110 expts)				NAAS, High Mowthorpe 1956–8 (mean of 3 yr.)			
s	y	y/s	s/y	s	y	y/s	s/y
0·7	19·0	27·2	0·0368	1·0	31·9	31·9	0·0314
1·1	20·5	18·6	0·0538	1·5	34·7	23·1	0·0433
1·7	**22·0**	12·8	0·0782	2·0	36·1	18·1	0·0553
2·2	21·5	9·8	0·1020	2·5	**38·5**	15·4	0·0650
2·6	21·0	8·1	0·1235				

rate and level of nitrogen, although this does not reach significance in all cases. On the other hand, Whybrew's data show a tendency for negative interaction. High base dressings of nitrogen were used in this work, however (0·22 cwt. N/acre in autumn + 0·30 cwt. N/acre in spring). There is less evidence of interaction with spring wheat and barley. Several of the latter experiments report increased lodging with both high seed rates and high nitrogen. It is of interest to note that the negative interaction in the 1955 spring-wheat experiments at Leeds University was associated with severe lodging (see Table 4). Glynne (1951) and Glynn and Slope (1957) reported increased lodging with both high nitrogen and seed rate in the case of winter wheat on eyespot-infected land and on Proctor barley. As lodging constitutes a severe hindrance to the full development of yield, as so clearly shown by Mulder (1954), it is suggested that there is normally a positive interaction between plant population and level of fertilizer, but this can be obscured or even converted into a negative interaction when lodging

Table 2. Cereals : population of plants and fertile tillers at maximum yield/acre

Crop and source	(a) Seed rate giving max. yield cwt./acre	Plant pop. millions/acre	Fertile tiller pop. millions/acre	(b) Yield cwt./acre
Winter Wheat				
Whybrew, 1958	0·7	0·60	1·20	42·9
NAAS, High Mowthorpe, 1960	1·1	0·95	—	26·4
Leeds University, 1960 ..	2·0	1·00	1·21	38·7
Harvey and Shepherd, 1958 ..	0·7	0·84	1·12	36·0
Spring Wheat				
NAAS, High Mowthorpe, 1960	1·9	2·06	—	21·2
Leeds University, 1960 ..	1·0	0·80	1·19	23·3
Harvey and Shepherd, 1958 ..	1·4	1·23	1·40	37·2
Barley				
Rennie, 1957	1·0	1·12	3·45	27·9

Table 3. Cereals : seed rate and response to nitrogen

(seed rate in cwt./acre, nitrogen in cwt./acre)

Winter Wheat

Leeds University, 1960		Bullen & Scragg, 1958		Jackson & Page, 1957		NAAS, High Mowthorpe, 1960		Whybrew, 1958	
Seed rate	Response to N 0·30 0·60	Seed rate	Response to N 0·30 0·60	Seed rate	Response to N 0·15 0·30	Seed rate	Response to N 0·23	Seed rate	Response to N 0·30 0·60
0·5	+0·6 +5·3	0·5	+1·7 +3·9	1·2	+3·3 +7·9	1·1	+0·6	0·7	+2·5 +2·0
1·0	+5·8 +8·1	1·0	+2·2 +3·9	2·0	+5·4 +7·0	2·2	—0·3	1·4	+2·4 +2·6
2·0	+6·2 +8·6	1·5	+5·2 +6·5	2·7	+5·7 +6·0			2·1	+0·5 +0·3
4·0	+6·2 +10·6								
Interaction significant 2 yr. out of 5.		Interaction ?		Interaction N.S.		Interaction N.S.		Interaction N.S.	

Spring Wheat **Barley**

Leeds University, 1960		NAAS, W. Midland Province, 1950–1		NAAS, High Mowthorpe, 1960		Jackson & Page, 1957		Rennie, 1957	
Seed rate	Response to N 1956 & 7 1955	Seed rate	Response to N	Seed rate	Response to N 0·15 0·30 0·45	Seed rate	Response to N 0·18	Seed rate	Response to N 0·15 0·30
0·5	+2·5 +6·4	1·0	+6·1	1·3	+1·9 +2·1 +3·9	1·1	+1·8	1·0	+2·2 +3·5
1·0	+2·0 +5·2	1·5	+5·2	1·9	+1·6 +3·4 +4·7	1·5	+1·8	1·5	+2·4 +4·3
2·0	+2·2 +3·5	1·75	+5·6	2·5	+1·0 +2·9 +4·3	2·2	+1·7	2·0	+2·2 +3·3
4·0	+2·6 +0·9					2·7	+1·4		
Interaction N.S.		Interaction N.S.		Interaction N.S.		Interaction N.S.		Interaction N.S.	

N.S. = Not significant.

Table 4. Lodging in spring wheat, 1955

(Leeds University, 1960)

Seed rate	% area lodged 8/7/55	
	Nitrogen applied	
	Nil	0·60 cwt./acre
cwt./aere	%	%
0·5	0	0
1·0	0	11·5
2·0	0·5	28·0
4·0	20·5	59·0

occurs. This would agree with Hudson's 1941 survey of seed-rate physical optima in different world climatic zones, which indicated that the higher the potential yield the higher the optima. Hudson related this to water as an environment resource ; the above relates it to nitrogen as an environment resource. The work of Crowther, Tomforde and Mahmoud (1935–6) with wheat in the Sudan gives some support to the concept that greater environment resources make for greater seed rate optima.

In most of the experiments quoted, no information on straw yield is given. In the experiments at Leeds University, air-dried straw weights have been measured and these are shown in Table 5. In 4 years out of 5 there were increases in straw yield at sowing rates up to 4·0 cwt. per acre. In the fifth year, in an experiment where defoliation of the spring vegetative growth was an experimental factor, the main effect of seed rate was non-significant.

The response curves of straw yield to seed rate appeared to be of the asymptotic form referred to in the introduction. It is of interest to note that as the straw initials are formed on the growing point before flower initiation, straw yield may be regarded as a product of vegetative growth, although internode extension is influenced by the flowering stimulus. This difference between grain and straw yield would indicate that cereals grown for silage or hay would need higher seed rates than those grown for grain.

An examination of the full data used in the preparation of Table 1 suggests the value of the term " coefficient of multiplication " (i.e. $M = Ya/s$ where Ya = yield per unit area and s = seed weight per unit area). The reciprocal of this term $1/M$ shows a curvilinear relation to seed rate to which a quadratic regression can be fitted. From this fact an expression equivalent to the one given for vegetative yield in the introduction can be deduced. It is

$$M = \frac{Ya}{s} = \frac{1}{a + bs + cs^2}$$

Let A = the " apparent " maximum coefficient of multiplication (M), assumed to be at $x = 0$.

$$\therefore \frac{Ya}{s} = A.\frac{1}{1 + Abs + Acs^2}$$

$$\text{Thus } Ya = As.\frac{1}{1 + Abs + Acs^2}$$

It may seem an unnecessary complication to replace Hudson's quadratic expression by this more complex equation. It is, however, much nearer to the true situation to regard the yield per unit area as being composed of the number of plants per unit area multiplied by the yield per plant, the latter decreasing with increasing plant density.

A particular value of the $1/M$ regression line is that its curvature is only slight, even when the direct relation between y and s shows pronounced curvature. This comparatively slight curvature is demonstrated by the winter- and spring-wheat data from Leeds University (1960), shown in Table 1, up to seed rates of 4 cwt. per acre. Graphical interpolation between, and limited extrapolation beyond, items of data derived from individual series of experiments, can therefore be carried out with greater confidence on the $1/M$ regression line compared with the direct $y : s$ relation. Such graphical methods have been used to calculate the mean values of $1/M$ (i.e. s/y) shown in Table 6 at incremental steps of 0·25 between 0·5 and 2·0 or 2·5 cwt. of seed per acre, using all the experimentally determined values of $1/M$ (or s/y) summarised in Table 1. From this, curves of mean grain yield/seed rate, such as those given in Fig. 1, can be prepared. (See Table 6.)

The data from Table 6 allows for the calculation of mean physical and economic seed-rate optima. Economic optima are given in terms of seed rates for maximum " net yields" determined from the values $y-s, y-2s$ and $y-3s$ (Table 7). This is done on the assumption that the value of the farm-produced seed will be approximately equal to the crop value, weight for weight, whereas that bought from the main seed firms may cost between two or three times this value. The physical optima calculated from all the data are greater than those calculated from Boyd's data (see also Fig. 1). The economic optima are not very different, however. The physical optimum for spring wheat is greater than that for winter wheat, a fact determined experimentally by Harvey and Shepherd (1958) using the same spring varieties sown in both spring and autumn.

It is to be noted that the relation between y and s shown above embraces the influence of all environmental factors between sowing the seed and harvesting the crop, as well as the factor of the viability of the seed itself. The grower would need to depart from the average seed rates given in Table 7 if the sowing was abnormally early or late. Seed beds with poor tilths would also

Table 5. Wheat : seed rate and weight of grain (14% moisture) and of air-dried straw (all figures in cwt./acre)

(Leeds University, 1960)

Seed rate	Winter wheat (mean of 5 yr.)		Spring wheat (mean of 3 yr.)	
	Grain	Straw	Grain	Straw
0·5	28·6	18·8	21·0	21·2
1·0	33·3	21·1	23·3	23·2
2·0	38·7	25·1	22·6	24·9
4·0	36·7	27·5	20·1	27·2

Table 6. Cereals : mean s/y and y values

Crop	Mean values of	Seed rate(s) in cwt./acre.								
		0·50	0·75	1·00	1·25	1·50	1·75	2·00	2·25	2·50
Winter wheat	s/y	0·0179	0·0254	0·0323	0·0398	0·0476	0·0559	0·0647	—	—
	y cwt/acre	27·9	29·5	30·9	31·4	31·5	31·3	30·9	—	—
Spring wheat	s/y	0·0229	0·0316	0·0398	0·0492	0·0581	0·0674	0·0766	0·0866	—
	y ,,	21·8	23·7	24·9	25·4	25·8	26·0	26·1	26·0	—
Spring barley	s/y	0·0189	0·0274	0·0359	0·0442	0·0532	0·0620	0·0715	—	—
	y ,,	26·4	27·4	27·9	28·3	28·2	28·2	28·0	—	—
Spring oats	s/y	0·0244	0·0323	0·0402	0·0483	0·0567	0·0646	0·0733	0·0820	0·0918
	y ,,	20·5	23·2	24·8	25·8	26·4	27·0	27·3	27·4	27·2

Table 7. Cereals : seed rates (cwt./acre) for physical and economic optima

Crop	y	$y-s$	$y-2s$	$y-3s$
Winter wheat	1·5	1·25	1·12	1·0
Spring wheat	2·0	1·5	1·1	1·0
Spring barley	1·25	1·25	1·0	0·75
Spring oats	2·25	2·0	1·75	1·25

call for adjustments. When there is sufficient experimental data on sowing-date and seed-rate effects upon yield, or indeed any other factor which may interact with seed rate to affect yield, the technique used above can be used to assess their mean effects.

2. PULSE CROPS

As with cereals, the yield of pulse crops is also a product of reproductive growth. Far less experimental work on plant population has been carried out on them compared with the cereals, however. What is accessible is summarised below.

PEAS. Reynolds (1950) showed from survey data that the customary sowing rate with peas for harvesting dry was 2·0 cwt. per acre at spacings of 7 in. between coulter rows. The range of seed rates used was from 1·1 cwt. to 2·75 cwt. per acre and the coulter row-spacings ranged from 4 in. to 24 in. In the same paper Reynolds summarised a series of 4 accurately conducted spacing trials which extended over 3 years. The seeds were sown by hand and were spaced accurately at 1 in., 2 in. and 3 in. in row-widths of 8 in., 16 in. and 24 in. As well as seed yield, a great deal of information on the various components of yield was obtained. The seed weight in terms of cwt. per acre and the seed yield in the same units for the 9 spacings are shown in Table 8.

These experiments showed that the row-spacing of 8 in. gave better yields than 16 in. and the latter was superior to 24 in. at each seed-spacing within the row. In each row-width, the 2-in. spacing gave better yields than either the 1-in. or 3-in. spacings. Thus the yield/plant population relation for each row-width was of the approximately parabolic type. The physical yield optima were at or about 0·8, 1·2 and 2·4 cwt. of seed for the 24-in., 16-in. and 8-in. rows, respectively. It is of interest to note that when the $1/M$ (or s/y) values of the 9 treatments are plotted against the seed rate(s), the seed spaced at 2 in. and 3 in. in the rows spaced 8 in., 16 in. and 24 in. apart, all lie on approximately a straight line. It is only the 1-in. seed-spacings in the 3 row-widths which depart materially from this straight line. An examination of the components of yield show that the yield reduction at 1-in. spacing is mainly due to a reduction in the number of pods per stem. A somewhat similar finding was obtained by Vincent (1958) in a 4-year programme of experiments with " green " peas in Washington. These were small-scale, accurately conducted trials rather similar to Reynolds' trials, using the same seed rate, but with plants spaced 4 in. × 4 in., 8 in. × 2 in. and 16 in. × 1 in. apart. The last plant spacing gave approximately 20% lower yields than the first two.

Table 8. Peas : spacing experiments

(Reynolds, 1950 ; mean of 4 experiments over 3 years)

Seed spacing	Wt. seed sown cwt./acre (s)			Dry yield cwt./acre (y)		
	Row spacing			Row spacing		
	24 in.	16 in.	8 in.	24 in.	16 in.	8 in.
3 in.	0·5	0·8	1·6	17·9	19·0	22·1
2 in.	0·8	1·2	2·4	18·2	19·5	22·8
1 in.	1·6	2·4	4·8	17·3	16·9	18·7

Table 9. Peas : seed rate trials

(Home Grown Threshed Peas Joint Committee, 1950–1)

Seed rate cwt./acre (s)	1·0	1·25	1·50	1·75	2·0	2·25
Mean s/y value	0·0406	0·0470	0·0533	0·0610	0·0685	0·0785
Mean value y cwt./acre	24·6	26·6	28·1	28·7	29·1	28·6
Economic optimum seed rate cwt./acre		$y-s$ 2·00		$y-2s$ 2·00		$y-3s$ 1·50

Table 10. Winter Beans : seed rate/yield experiments

Source	Mean of	Seed rate (s) in cwt./acre (± 0·2 cwt.)							
		1·2	1·6	2·0	2·4	2·8	3·2	3·6	4·0
		yield (y in cwt./acre)							
NAAS, Boxworth, 1953–4	2 yr.	21·5			20·2			20·9	
NAAS, Drayton, 1958	1 yr.	21·7	20·1						
Garner and Sanders, 1935		14·5	18·0						
Rothamsted Expt. Sta., 1945	1 yr.		12·0			19·0			22·0
Rothamsted Expt. Sta., 1946	1 yr.			19·5		21·5			
NAAS, S.W. Province, 1949-50	2 yr.	13·7	13·7	16·0	14·8				
Mean s/y values		0·0759	0·0932	0·1118	0·1321	0·1525	0·1730	0·1945	0·2139
Mean yield (y)		15·8	17·2	17·9	18·2	18·4	18·5	18·5	18·7
Economic optima $y-s$		14·6	15·6	**15·9**	15·8	15·6	—	—	—
$y-2s$		13·4	**14·0**	13·9	13·4	—	—	—	—
$y-3s$		12·2	**12·4**	—	—	—	—	—	—

In field-scale population trials the same perfection of spacing and weed control cannot normally be obtained. Reynolds (1950) reports that the highest yields were obtained with close-spaced rows (i.e. 7 in.–8 in.) in 10 out of 18 experiments, whilst in 6, medium row-widths (i.e. 14 in.–16 in.) gave the best yields. He also reported that low (i.e. 1·25–1·75 cwt.) or medium (i.e. 1·85–2·25 cwt.) seed rates gave the best results in 8 experiments out of 9. Seven experiments conducted by the Home Grown Threshed Peas Joint Committee (1950–1) between 1949 and 1951 are reported in more detail. The results of these are summarised in Table 9, using the same $1/M$ (or s/y) technique as used above for cereals.

It will be seen from Table 9 that the mean physical optimum seed rate in this series of experiments is 2·0 cwt. per acre. The economic optimum is at the same seed rate, except in cases where the cost of the seed amounts to three times the value of the crop produce, weight for weight, in which case the optimum is at 1·50 cwt. of seed per acre.

BEANS. In the bean crop it has been shown that only approximately 20%–30% of the flowers produce seed-bearing pods (Rowlands, 1955). The exact reason for this is a matter of controversy but failure of the pollination mechanism is considered to be an important reason, whether caused by a shortage of insects or for other reasons is uncertain. Soper (1952), from survey data, showed that the number of pods set per plant in 3 years varied from 6·5 to 11·1 and from 286 to 683 $\times$ 10^3 per acre. Soper's survey also indicated that the yield of pods increased with higher plant populations on fertile soil, but decreased with similarly high populations on low-fertility soils. With winter bean experiments at Boxworth (NAAS, 1953; 1954), both the pod number and the stem number per plant decreased with increased sowing rates.

Data from a number of seed rate/yield trials have been published in various places. Those concerned with winter beans are brought together in Table 10. All the results are examined by the $1/M$ (or s/y) techniques at the base of the table and the mean values of $y : s$ relation are calculated. This has involved rather greater extrapolations with some items of data than is perhaps safe.

It will be seen that although individual experiments show evidence of a decline in yield above a certain seed rate (see Boxworth, Drayton and S.W. Province), the mean curve, bearing in mind the reservation made above, increases up to 4·0 cwt. of seed per acre and tends to level off at about 2·0 cwt. of seed per acre.

There is insufficient evidence in the literature to say whether spring beans differ materially from winter beans in their seed-rate requirements.

It is of interest to note that in the 2 years of work at Boxworth, although the maximum grain yield occurred at the low seed rate, there were increases in straw yield up to the highest seed rate.

The mean straw yields were 20·3, 23·3 and 25·7 cwt. per acre with 1·18, 2·36 and 3·54 cwt. of seed, respectively. Thus the situation with this crop is parallel to that existing in the winter wheat crop mentioned above.

Earlier Rothamsted experiments (Rothamsted, 1935–7) indicated that the narrower row-widths of 16 in.–18in., gave superior results, in both grain and straw yields, to rows 24 in. apart. More recent NAAS work has shown variation in the effect of row-width upon the crop.

3. OTHER SEED CROPS

LINSEED. Seed rate and yield data on this crop have been published by Harvey (1949) and by Blackman and Bunting (1951). In the former case, seed rates of 25, 40 and 75 lb. per acre gave significantly higher yields at the 2 higher sowing rates compared with the lower one. In the latter work, an increased yield was obtained by increasing the seed rate from 40 to 80 lb., but not beyond 80 lb. Blackman and Bunting showed that in some cases yield increases were obtained beyond 80 lb. seed per acre if the row-width was reduced to 4 in. These workers also point out that the higher moisture regimes of the British Isles warrant higher seed rates than those used in Canada and the USA.

MAIZE. Although maize is a crop of only minor importance in this country, it is of interest to note that in work carried out in this country (Bunting and Willey, 1959) and in the Sudan (Crowther *et al.*, 1937), grain yield showed the parabolic type of curve, whereas the yield of stover showed the asymptotic type of curve, when the plant population was increased. The corollary is that when the crop is grown for grain, a specific optimum seed rate exists, but when grown for silage no such physical optimum exists and higher seed rates have an advantage in terms of total dry matter yield.

(Part 2 of this article will appear in *Field Crop Abstracts*, **13**, No. 4.)

REVIEW ARTICLE

PHOTOSYNTHESIS AND THE THEORY OF OBTAINING HIGH CROP YIELDS, BY A. A. NIČIPOROVIČ.

AN ABSTRACT WITH COMMENTARY

BY

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This 15th Timirjazev Lecture was delivered by Prof. A. A. Ničiporovič of the Timirjazev Institute of Plant Physiology, Moscow, in June, 1954 and was published by the USSR Academy of Sciences in 1956. The following abstract was prepared from a translation* from the Russian, made in 1959 by the Department of Scientific and Industrial Research, Gt. Britain, and retains the subdivisions and section headings of the original.

Introduction

The basic problem in agriculture is how to obtain high crops yields, but despite the work of many specialists in different branches of agricultural science, no general theory has as yet been derived from the accumulated data. What is required is an estimate of the theoretically possible yield in any circumstances and an understanding of the optimal course of crop growth and development. It may then be possible to bridge the gap between current yields and theoretically possible yields by systematic reasoning rather than by chance discoveries.

Plant nutrition and crop production

Plant nutrition includes both organic and inorganic aspects ; nutrients must be properly assimilated and used firstly in leaf and root growth and secondly to form economically valuable parts of the plant. Deviations from the optimal course of growth result in lower yield, and agriculture is a system of establishing conditions that will minimize these deviations.

Photosynthesis as a basic process of feeding green plants

Photosynthesis is the most characteristic and important process in the nutrition of green plants, whereby all the carbon (42–45% of dry weight) and hence all organic matter (90–95% dry weight) is accumulated. For instance, in a period of rapid growth, the dry weight of a crop may increase by 80–150 (500) kg/ha/day† ; at this rate, the crop assimilates 1–2 kg N/ha/day, 0·25–0·5 kg P, 2–4 kg K, 2–4 kg other elements, 150–300 (1000) kg CO_2 (corresponding to an air layer 30–60 m deep). Usually, mineral elements or water are in limiting supply, but affect growth and yield only in so far as they affect photosynthesis ; agriculture is basically a system of exploiting photosynthesis.

Progress of crop production in relation to photosynthetic activity of plants

A distinction must be made between the economic yield of a crop (e.g. grain, tubers, etc.) and the total dry-matter yield or biological yield, although they are closely related. Biological yield is the sum of the daily increments in dry weight, which vary from low values at the beginning and end of the growing period to 150–300 (500) kg/ha/day at the time of greatest growth. The length of the growing period is commonly 80–150 (180) days. The magnitude of the daily increment depends on the leaf area and the efficiency of photosynthesis. The summation of leaf area per unit land area (Leaf Area Index, L) for each day throughout the growing period is called the leaf area duration (D), and by dividing the biological yield by D the average amount of dry matter formed per day by each unit of leaf area is obtained ; this may be given as dry matter in g/m² /day, and is referred to as Net Assimilation Rate (E). However, mean E over short periods is usually of more interest than over the whole growth period ; it may be calculated from dry weights and leaf area at the beginning and end of each experimental interval. E is

*Enquiries for the full translation should be sent to: Translating Section, DSIR Lending Library Unit, 20 Chester Terrace, London, N.W.1., quoting the reference RTS 1069.

†The first two figures presumably represent the common range, and the third figure, in brackets, the highest observed value.

the summation of the rate of photosynthesis (i.e. g CO_2/m^2/day assimilated), less the rate of loss by respiration and death of tissue which in average conditions together amount to about 20–25% of the total daily photosynthetic product. If the direct product of photosynthesis is carbohydrate, 0·64 g carbohydrate is formed per g CO_2 assimilated, so that to obtain a measure of net daily dry-matter production the daily assimilation of CO_2 must be multiplied by a factor of 0·50–0·55 (i.e. 20–25% less than 0·64). This factor (the " coefficient of effectiveness of photosynthesis ", Kp) varies with conditions, particularly those affecting respiratory loss, from 0 or even negative values (in drought, high temperatures, etc.) to values of 0·55–0·60. In practice E ranges from 2 to 12 g/m^2 leaf area/day, 14–84 g/m^2/week.

In order that economic yield may be as large as possible, the product of photosynthesis must be correctly distributed at the right time to useful parts of the plants. The fraction of the product so utilized is called the " coefficient of effectiveness of formation of the economic part of the total yield " (K_E)*.

From these considerations it follows that highest yields will be obtained in the following conditions :

(1) optimal growth in L.
(2) maximal duration of photosynthetic activity, each day and over the growth period.
(3) maximal rate of photosynthesis, maximal Kp and hence maximal E.
(4) from (3), maximal daily accumulation of dry matter by the crop.
(5) optimal utilization and distribution of the products of photosynthesis, i.e. maximal K_E.

Growth in leaf area as a determinant of high yield

A. FORMATION OF LEAVES ON INDIVIDUAL PLANTS

The progress of growth in leaf area is determined by the balance of formation and expansion of individual leaves, by their longevity and death, and is affected by environmental conditions. There is a wide range in dry weight between plants — from 1 g in ephemerals to 500 g in some quick growing crops. Although the leaf area per plant of an ephemeral is no more than 100 cm^2, of a cereal 750 cm^2, of potato 1 m^2, of a large tree 70 m^2, differences in E are comparatively small. Variation in dry-matter production is far more dependent on variation in leaf area than on variation in E.

B. LEAF GROWTH OF FIELD CROPS AND OF NATURAL VEGETATION

To obtain high yields, the leaves must photosynthesise as much as possible and eventually transfer material to the economically valuable parts of the plant. Despite differences in leaf size and number, L of growing crops is fairly uniform, ranging from 2·5 to 5·0 at greatest development. As the highest yield of a crop is found with close spacings, at which individual plants weigh less than when widely spaced, leaf area must be considered on the basis of unit area of land. For high yield, it is important to attain maximal leaf area as rapidly as possible. In cotton, increasing density of planting leads to increased L but decreased E, so that yield is maximal when L is 2·0 ; yield is decreased when L is larger. Similarly, seed yield of soyabeans is greater for thin than for thick sowings, because in the latter the lower leaves that feed the pods are shaded. In cereals, increase in L above 2 or 3 fails to increase yield and may cause lodging ; too high L in potatoes leads to excess haulm growth and decrease in tuber yields and starch content, and in sugar-beet to decreased sugar content. Hence highest yields of best quality are obtained from crops having optimal L and an optimal course of leaf formation. The conditions under which these are achieved are :

(1) L during the growth period must be sufficient to absorb as much of the incoming photosynthetically active radiation as possible.
(2) mutual shading of leaves must not be so severe that some leaves become parasitic upon the plant.
(3) light conditions within the crop, which depend on L, must suit the purpose for which the crop is grown, e.g. flax grown for fibre requires different plant densities from flax grown for seed.
(4) leaves evaporate moisture and so leaf growth must be adjusted to the moisture available to the crop.

Photosynthesis and radiation intensity

High intensities of solar radiation are required for maximum photosynthesis. The only radiation active in photosynthesis is that absorbed by chlorophyll, limited to the wave band 400–750 mμ, and of this plants absorb about 80–85%. Outside this wave band, infra-red radiation contributes to the energy budget of leaves, about 25% of radiation in the band 1100–2500mμ being absorbed by the water in the leaves. Assuming that infra-red comprises 50% of the solar radiation, and that leaves absorb 85% of photosynthetically active radiation and 25% of the infra-red, the total absorption is 55%. Reduction of 1 mol (44 g) CO_2 requires 112 K cal energy, to give 30 g of photosynthate. Experience with crop plants shows that photosynthesis balances respiration at a radiation intensity of about 20–30 K cal/m^2/hr, and

*Later referred to in this abstract as " coefficient of economic yield ".

increases with increase in radiation to about 360–420 K cal/m²/hr, thereafter levelling off. The percentage utilization of energy in photosynthesis is maximal (2·5–3%) at about 100–200 K cal/m²/hr. These relationships suggest that L should be sufficiently large to absorb as much as possible of the incoming solar energy. This condition involves some mutual shading of leaves, but still higher L with more severe mutual shading has adverse effects.

Utilization of incident energy of solar radiation by crops of different structure

Various investigations confirm that about 20–25% of incoming radiation is reflected by plants or by soil, and a value of 20% will be assumed, although it will vary with the soil type, the plants and their stage of growth. In a freshly sown field, 20% incident radiation is reflected and 80% absorbed by the soil ; as the crop grows, smaller and smaller amounts reach the soil surface.

Some values of the percentage of radiation reaching ground level are : woodland, 7–25 ; field crops (in Russia) 10–20 ; cotton 40 ; undersown cereal crops (in USA) 20–30. In potatoes with L = 2, 25% radiation reached ground level at noon, 10% in the morning and evening, whereas in oats the value with L = 2–2·6, was 50%, and in sunflowers and sorghum grown for silage with L = 7–11, 30–40%. Analysing all available evidence, light absorption increases to 50–70% as L increases to 2·5, reaching 60–80% at 4 ; however, the relationship will vary with type of crop, and agronomic considerations.

It is concluded that crops with L of 3–4 and 7–10 will absorb similar amounts of energy and will not differ in the possible photosynthetic activity nor in transpiration. However, a decline in quality may be associated with excessive L, when lower leaves may be heavily shaded and subjected to critically low light intensities. While an individual leaf shows maximum photosynthesis at perhaps 50% daylight, the photosynthesis of a crop where the lower leaves are shaded will be decreased by smaller diminutions in light ; the thicker the stand, the greater this decrease.

It is concluded that the optimum course of leaf development is for an early attainment of L = 3·0–3·5, or up to 4 in high radiation conditions, followed by stable values and a final decline when mobile substances can be transferred to economically valuable parts.

L is frequently less than optimal because of low fertility, drought or low plant populations, so giving poor yields, but it may often be too large, perhaps reaching 10. The lower leaves then respire more material than they produce, and the amount of material translocated to other organs is decreased. With forage crops, L may reach 6–8 and although high L of this order will not contribute to greater light absorption, the leaf is here itself the economic fraction.

Optimum L varies for different crops, and only grain, fruit, tuber and root crops will be considered.

Energy balance and water regime of plants

To obtain an estimate of the energy balance of leaves, it may be assumed that solar radiation is 420 K cal/m²/hr ; 85% of photosynthetically active radiation is absorbed and 25% of the infrared. Hence 55%, i.e. 235 K cal/m²/hr, is absorbed, of which about 2% is utilized in photosynthesis, 3·5–4·7 K cal/m²/hr. The calorific content of 1g of photosynthate is about 4 K cal. Therefore, 0·8–1·2 g dry matter (0·7–1·0 g after deducting respiration) is formed by the leaves. The rest of the energy absorbed (230 K cal/m²/hr) must be converted into sensible heat or be used to evaporate water. At 20°C, 586 cal are used per g water evaporated, so that 390 g/m²/hr water will be evaporated, if water is freely available. It is important to note that the formation of leaf area creates not only an assimilating but also an evaporating surface.

Optimum leaf growth from the point of view of water relations

Optimum leaf growth of a crop requires that water supply must be sufficient to meet the evaporation rate as determined by the energy budget ; in fact the water required during the growing period can be calculated from the amount of radiation reaching the crop and from the graph of optimum leaf growth, which defines the proportion of the radiation that is absorbed.

Results so calculated agree well with observed data. Calculations for different parts of Russia show that field crops with leaf areas optimal for photosynthesis may often be short of water ; in these places L is frequently less — sometimes very much less — than the optimum. Periods of water shortage reduce leaf development so that L is related to the soil moisture ; for instance, rapid leaf growth after emergence can lead to the soil drying out, so that the growth of initially good crops is inhibited earlier than of crops having a slow early leaf development. This interdependence of L and water supply will vary from season to season with differences in radiation, precipitation, irrigation, etc., and, in addition, crop plants differ in their degree of drought- and heat-resistance.

High yields require that leaf growth approximates to an optimum course for absorption of radiation, and where it diverges, yields may be increased by improved water supply, weed control, nutrition, etc. Water shortages cannot easily be overcome and less than optimal leaf area must often be accepted. When leaf growth is optimal, further increases in yield can be obtained only by increasing either the efficiency of photosynthesis or the transfer of more material to economic parts of the plant.

Net assimiliation rate as a determinant of crop yield

Net assimilation rate (E) has been measured by British scientists for many crops in different geographic regions. They concluded that E is not very variable, and that differences in yield are determined mainly by differences in leaf area. Weather was thought to be more important than nutrition in determining E, possibly because most of the experiments were done in mesic conditions where increased fertilizer application might increase mutual shading. However, Russian work does not confirm the British conclusions and suggests that variations in E are as important as variations in leaf area in determining yield. The optimum course of crop growth depends on changes in photosynthesis with ontogeny, but E is assumed to increase rapidly from emergence to a stable optimum level, with a decline at the end of the growing period.

Russian and British results show that E averages 4–6 g/m²/day, varying from 2 to 14 g/m²/day under extreme conditions. The aim should be to achieve 5 g/m²/day at the beginning of the growing period, rising to a stable value of 10. With optimal L these values imply yields up to 30 t/ha in a growing period of 150 days, corresponding to economic yields that are high, but possible. Such yields do not, however, represent the attainable limits.

Daily course of photosynthesis of plants in field conditions and the coefficient of effective photosynthesis

The daily course of photosynthesis in field conditions shows a period of maximum activity in the morning, followed frequently by a midday drop and a secondary maximum in the afternoon. The midday drop is most marked when the water supply is inadequate and may be absent in conditions of adequate soil moisture, low temperatures and cloud. E can be derived from the total daily assimilation of CO_2 multiplied by the coefficient of effective photosynthesis (to allow for respiratory losses, etc.). This coefficient, as already discussed, may be taken as 0·5. Therefore, to obtain net productivity values of 10 g/m²/day, as used in constructing the optimum course of crop growth, photosynthetic intensities of 20–22 mg CO_2/dm² leaf area/hr are required if no midday depression is experienced, and up to 30 mg/dm²/hr where there is a depression.

In practice, photosynthetic intensities sufficient to yield up to 20 g/m²/day of dry matter have been observed, and should be regularly attainable under favourable conditions. However, these high values of photosynthetic activity relate to individual leaves, whereas in a crop many leaves are shaded.

The coefficient of effective photosynthesis, taken as 0·5, may vary from 0·6 to zero or negative values. Low values are found under unfavourable conditions (high temperatures, drought) when the period of photosynthesis is shortened and that of respiration lengthened ; the daily loss by respiration may then even exceed the gain from photosynthesis. Little is known of how the coefficient of effective photosynthesis varies, and this requires further study, particularly for the whole crop rather than for individual leaves. Another problem is the composition of the photosynthetic products and its bearing on crop quality.

Theoretically possible rates and amounts of photosynthesis and the coefficient of economic yield

Discussion of the optimal courses of leaf growth and photosynthesis has so far been based on measurements by several workers, but the possible magnitudes of the rates of photosynthesis and of E can also be derived theoretically. Very high intensities of photosynthesis, up to 100 mg CO_2/dm²/hr have been reported, so the assumed normal values of 10–15 mg CO_2/dm²/hr are probably too low because of technical defects in the methods of gas analysis.

Exploitation of these high intensities would produce plants that give increased economic yields without undue increase in leaf area. Furthermore, in very favourable moisture and fertility conditions, biological yield is frequently increased without a concomitant increase in economic yield — i.e. the coefficient of economic yield is reduced. This may perhaps be because of increased leaf growth, and hence greater mutual shading, at high levels of fertility.

As a basis for analysis of the light phase of photosynthesis, it is known that 112 K cal of energy are needed to reduce 1 g mol of CO_2, and there is evidence that an absorption of 12 quanta per molecule of CO_2 is needed in photosynthesis. Assuming a mean frequency for the absorbed radiation, the necessary absorption is 600 K cal per g mol of CO_2. Hence the leaf has to take up 600 K cal of visible radiation in order that 112 K cal shall be used in photosynthesis, i.e. 19% of the absorbed part of incident visible radiation, or 16% of visible radiation incident on the leaf. As about half of the total solar radiation is in the infra-red it is to be expected that about 8% of total radiation can be bound in photosynthesis ; and this value can be used as a measure of what might be achieved in increasing yields. As already shown, at normal light intensity and at a photosynthetic rate of 2·5 g CO_2/m²/hr about 1% of solar energy is bound in photosynthesis.

In the field, however, absorption is not complete and, for $L = 3$ or 3·5, is about 65% of the

incident energy. As only 19% of this can be effectively used and only 65%* is photosynthetically active the field efficiency is $0{\cdot}65 \times 0{\cdot}19 \times 0{\cdot}65 = 7{\cdot}9\%$. Of this, 25% has to be written off for respiration so that the largest figure for field growth is 6% of total radiation.

The daily amount of incident solar energy varies with latitude from $2\text{–}10 \times 10^7$ K cal/ha/day, and at a calorific value of 4 K cal/g of the dry matter of the crop, daily increases of 300–1200 kg/ha may be expected, assuming a 6% utilization of total energy. These increases correspond to net assimilation rates of 9–35 g/m²/day ; values of 10 are now possible, values of 15–20 are probable, but require further work by agricultural scientists ; values of 20–35 have now been shown to be theoretically possible but could be obtained only after marked changes in plant material and farming systems.

Over the whole growing period, conversions of 6% cannot be maintained, because L must be less than the optimum for part of the growing period and a smaller percentage of the incident energy is absorbed ; a value of 4% may be more realistic for the whole growing period. Then during a growing period of 80–120 days, a crop may receive $4\text{–}12 \times 10^9$ K cal solar radiation per ha ; at 4% conversion, biological yields of 60–80 t/ha of dry matter would be obtained. This analysis suggests that theoretically possible yields many times higher than the present average can be obtained and should be aimed at.

The carbon dioxide problem

The supply of CO_2 sufficient for yields of 450 kg/ha/day would amount to 900 kg/ha/day. Soil respiration liberates 25–50 kg CO_2/ha/day, or with cultivation and irrigation possibly 150 kg ; hence it supplies only part of the crop requirement. Assuming that 20% of the biological yield remains in the soil as roots, and that a further 20% is returned as organic manure, 40% of the yield is retained in or returned to the soil. Even if this material is completely oxidised, the resulting CO_2 could satisfy only a small part of crop requirements. Introducing carbonaceous fertilizers (e.g. organic materials or carbonates) has a limited potential and the main source of CO_2 must be the air.

To maintain high rates of photosynthesis, a large volume of air from which CO_2 can quickly diffuse to the leaf must be available. A flow of air up to 7·5 l/cm²/hr may compensate for the low natural concentration of CO_2 in the air, and can ensure very high intensities of photosynthesis. The most important factor in this connection is the convective flow of air. Since almost complete stomatal closure is required before a reduction in photosynthesis occurs, there is no reason why very rapid diffusion of CO_2 into the leaf cannot be maintained.

In accordance with the optimum course of crop growth, up to 1000 kg CO_2/ha/day must be assimilated, an amount contained in 2×10^6 m³ of air, i.e. in an air layer of 200 m over 1 ha of crop. At an average convective flow of 60 m/hr, a layer of air 1 m thick will be changed 60 times per hr, ensuring that a supply of 5000 kg CO_2 per day reaches the leaves — many times more than is necessary for the high yields quoted, and enough for biological yields of 50 t/ha.

Mineral nutrition

Perhaps the most difficult problem in obtaining high yields is to ensure appropriate mineral nutrition of the plants. Too large increases in fertilizer application may lead to unbalanced nutrition and so to less economic yield and loss of quality of the product. Possibly the best source of mineral nutrients for crops is organic manure, which supplies them in appropriate proportions.

Much more work is needed on the relation between nutrient requirement and the optimal course of crop growth. Fertilizer applications cannot be considered without reference to soil type and cultivations. In conditions of high fertility, maximal use of available nutrients can only occur when photosynthetic activity is high. A diminishing return from increasing fertilizer application might be offset by increased photosynthetic efficiency obtained by selection of suitable varieties. Similarly, where soil moisture supply is restricted, sub-optimal L may have to be accepted and increased yields obtained by increase in E. Even when precipitation is limited, yields of 20–40 t/ha can be expected while, under irrigation or with a high water-table, yields of 60 t/ha should be possible.

Summary

The analysis has distinguished factors that cause yields to vary. The quoted values of the coefficients and factors discussed require adjustment for particular crops and environments, but can be used to answer the following questions :

(a) what are the potential and theoretically possible capacities of a given crop ?
(b) in what ways should a crop grow and develop to give the highest yields ?
(c) to what extent do the processes of crop growth diverge from the optimum and which processes should be examined — growth in leaf area, net assimilation rate or the coefficient of economic yields ?

Increase in crop yield may be achieved by developing agronomic methods to achieve optimal time changes in the processes of crop growth.

*Previously assumed to be 50% (p. 170).

COMMENTARY

In this lecture Ničiporovič discusses the possibility of increasing productivity of crops as an integrated problem in plant physiology, depending fundamentally on control of photosynthesis, rather than as a collection of separate agronomic problems. He distinguishes the attributes of the photosynthetic system of a crop that are important determinants of yield and gives data to show their magnitudes at different stages of growth and their variation in current systems of husbandry.

Next he attempts to assess what their optimal values should be, i.e. the values that would give maximum utilisation of solar energy in photosynthesis, and how they depend on agronomic and climatic factors. Finally, he makes estimates of potential maximum yield from a theoretical consideration of the energy relations of photosynthesis, which imply that much higher net assimilation rates and yields should be possible than those achieved at present.

The concepts and principles on which Ničiporovič bases his analysis will be familiar to anyone acquainted with recent work in the West on this subject, but they were not so widely known nor so generally accepted at the time when the lectures were delivered as they have since become. A valuable and original contribution is the suggestion that the success of crop husbandry should be judged not by comparison with the average or maximum of the current range of yields, but by how far the yield attained falls below what is theoretically possible. If, as Ničiporovič concludes, a large gap exists between present yields and what could be achieved by the best adjustment between the crop and its environment, it must act as a warning against complacency and a stimulus for further efforts to improve husbandry practices.

The rate of dry-matter production per unit area of land increases with increase in leaf-area index, and hence in the quantity of light energy absorbed, to a maximum that is reached when mutual shading of leaves offsets the advantage of further increase in photosynthetic capacity ; at this stage the leaves intercept and absorb nearly all the incident light. Ničiporovič assumes that maximal dry-matter production occurs when L is about 3 to 3·5, although he notes that optimal L may vary between species. Subsequent experiments in other parts of the world have confirmed this value for kale, but have shown that optimal L is much higher for pasture, sugar-beet and barley (Brougham, 1956, 1958 ; Donald and Black, 1958 ; Watson, 1958 ; Watson and French, 1958). It also varies with intensity of insolation and probably with change in leaf morphology associated with age (Brougham, 1956 ; Black, 1958 ; Blackman and Black, 1959; Saeki, 1960). Some improvements in yield may directly involve an increase in optimal L. Thus, there is evidence from a comparison of sugar-beet and wild beet that selection and breeding has increased yield within this species by inducing morphological changes, presumably in the spatial arrangement of leaves, that mitigate the effect of mutual shading, making E less dependent on L (Watson and Witts, 1959) and this implies a higher optimal L for sugar-beet than for wild beet. Control of mutual shading of leaves in order to raise optimal L as far as possible may, in fact, prove to be the most important way of achieving increased productivity, although this aspect is not considered by Ničiporovič.

Incidentally, Ničiporovič seems to imply that there is little mutual shading when L is below the optimum for dry-matter production ; i.e. less than about 3 ; however, the results for kale indicate that mean E is affected by mutual shading throughout the range of L from 1 to 3 (Watson, 1958).

The suggestion that high rates of air flow downwards towards a crop can compensate for the low CO_2 concentration in the atmosphere and ensure very high rates of movement of CO_2 into leaves is erroneous. Convective air movement at ground level is too slight to measure. New supplies of CO_2 are brought in by downward eddy-diffusion from air moving horizontally, and, except in very calm conditions, atmospheric transport processes are sufficiently active to maintain the CO_2 concentration near to 0·03% above the crop. High rates of air flow cannot increase it further.

Ničiporovič concludes that daily net assimilation rates up to three times as great as the maximal mean rates so far recorded in intervals of one or two weeks are possible. This is based partly on comparisons with exceptionally high rates of photosynthesis found for isolated leaves in the laboratory, and partly on the assumption that higher efficiency of utilisation of incident solar energy by field crops is possible. If optimal L is supposed to remain constant, increased energy utilisation in photosynthesis obviously requires a corresponding increase in E. Ničiporovič considers that the highest efficiency possible for field crops is about 6% of total radiation (15% of light energy). The highest figures so far recorded, in favourable short intervals in summer, are 4% of total radiation (9% of light energy) for sugar-beet (Gaastra, 1958 ; Blackman and Black, 1959) and 5·5% of total radiation (14% of light energy) for barley (Kamel, 1959). It is noteworthy that this high efficiency of barley was achieved by very high L (7 in one experiment and 11 in another, not including leaf sheaths), offsetting the low E characteristic of cereals. These results do not suggest that there is a very large disparity between current maximal and potential maximal efficiencies of energy utilisation by field crops, though, of course, current average efficiencies fall far short of the maxima. Gaastra

(1958) showed by a detailed comparison of estimated photosynthetic rates of sugar-beet leaves in field conditions with measured optimal rates at comparable light intensities in the laboratory, that the rate in the field was at least 60% of the optimal rate during a great part of the season. Similarly, calculations by Saeki (1960) based on the relation between photosynthetic rate and light intensity measured in the laboratory, and the vertical distribution of leaf area and light intensity within crops, gave estimates of E that agree closely with the maximal values for field crops quoted by Blackman and Black (1959). It follows that improvement in the efficiency of utilisation of sunlight in crop production involves either increasing the efficiency of the photosynthetic process itself, which probably depends on finding species with more efficient leaves than those at present in cultivation, or securing better distribution of light over the whole leaf area, which brings us back again to control of mutual shading of leaves.

Ničiporovič considers that with a 6% maximal efficiency of utilisation of total radiation, an average efficiency of 4% for the whole growth period should be possible. However, Kamel (1959) found that the average efficiency for barley was only one-quarter to one-third of the maximal efficiency, and for mangold less than half the maximum. The higher ratio postulated by Ničiporovič would evidently require L to be maintained close to its optimum for a much larger part of the growth period than is achieved by present methods of husbandry. How this is to be accomplished is not immediately obvious. It may be possible to increase the rates of leaf production and expansion at the beginning of the growing period by improved control of nutrient and water supply or temperature, or by use of growth substances, so that optimal L is more rapidly attained, but to hold L steady near to its optimum for the rest of the growing period will require a radical change in the normal pattern of leaf growth.

Ničiporovič rightly stresses the distinction between economic and biological yield, and the importance of ensuring that the highest possible fraction of total dry matter is produced in an economically valuable form. However, his discussion seems to assume that the final distribution of dry matter is the result of a phase of accumulation followed ' at the right time' by a phase of partition, but this is evidently not always true. For example, in the production of sucrose in sugar-beet roots dry-matter accumulation goes on simultaneously with its partition between useful and waste products throughout most of the growing period. On the other hand, although the ' economic yield ' of the barley crop, the grain, is not formed until a late stage of the growing period, the dry matter it contains is derived from photosynthesis during this stage and not from previously accumulated photosynthate. Little is known as yet of the internal and external factors that control dry-matter distribution, and more attention must be paid to this aspect of the yield problem in future research.

Although the conclusions of these lectures can be criticised in the light of later work, they are nevertheless valuable because they characterise clearly the many and varied components of the complex system involved in crop production, and show that achievement of maximal yield depends not on improvements in a single component but on control of the interactions between them.

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FIELD CROPS

CEREALS

WHEAT

See also Abs. 1098, 1197, 1501.

1045 Department of Agriculture, South Australia. **Cereal soil fertility trials.** *J. Dep. Agric. S. Aust.* 1960, **63**, No. 7, 275–80, illus.

In soil moisture trials at 5 centres in S. Australia, long winter fallows resulted in increased wheat yields. Summer-fallow treatments were no more effective than no-fallow treatments.—S.M.J.

1046 Khan, A. R. **Studies on tillage. 3. Effect of frequency of cultivation for seedbed preparation, with and without fertilizer and weeding on the yield of wheat.** *Indian J. agric. Sci.* 1958, **28**, No. 3, 345–54, bibl. 19. [Indian Agric. Res. Inst., New Delhi]

Of 4 ploughing frequencies (3, 6, 9, 12), carried out during the preparation of land for wheat, 9 gave the highest grain yield in each of 4 years with an average of about 1500 lb./acre. Weeding significantly increased grain yields but the increased financial return was only enough to meet the cost.—D.B.

1047 Mastenbroek, C. Twee jaar zaaitijdenproeven met Apollo en Bonus. [**A 2-year date-of-sowing trial with Apollo and Bonus winter wheat.**] *Meded. nat. coöp. Aan- en Verkoopv. Landb. Cent. Bur.* 1959, **43**, No. 10, 136.

Apollo and Bonus winter wheat were sown in the Netherlands on 7 dates between 15 Oct. 1957 and 4 Feb. 1958, and on 5 dates between 29 Oct. and 24 Dec. 1958. Highest grain yields were obtained from Oct. sowings. Sowings in Nov. and in Dec. reduced yields by 5% and 10%, respectively, and decreased grain quality. Hard frost did not occur during either growing season.—R.B.

1048 Laude, H. H. and Pauli, A. W. **Simulated hail injuries to winter wheat.** *Bull. 402 Kansas agric. Exp. Sta.* 1959, pp. 48, bibl. 22, illus.

The effect of simulated hail damage (close mowing, leaf removal, stem bending and damage to spikelets) in winter wheat was investigated between 1949 and 1956. Reductions in grain yield caused by leaf destruction increased from nil where the plants were injured more than 6 weeks before heading, to 30% reduction where leaves were removed at the boot stage, and decreased again with progressively later defoliation. Grazing the wheat stand during the winter had the same effect on grain yields as mowing at the time the grazing period ended. Mowing the plants close to the ground within 14–30 days of earing reduced grain yields by 78%, while mowing just above the ear primordia at the same stage of growth reduced yields by 20%. Defoliation at the boot or earing stage reduced the number of grains per ear and the size of the grain, while later defoliation reduced the grain size only. Defoliation decreased the grain protein content. Bending injury to the lower part of the stem decreased the number of grains per ear and reduced grain yields by 20% when inflicted at the boot stage, and decreased grain size and reduced yields by 35% where injury occurred at the middle of the fruiting stage. Grain protein content was increased by stem damage. Stem damage inflicted above the leaves had less effect on grain yield than did stem damage nearer the base of the plant. Immature ears which fell off following injury to the upper part of the stem were potentially larger than those remaining on the plants. Injury above the ear at the boot stage reduced grain yields by 25%. The effect of damage to plants on their grain yields was independent of the extent of damage to neighbouring plants. Yields of undamaged plants were not influenced by damage to neighbouring plants. F. S.—R.B.

1049 Penman, H. L. and Long, I. F. **Weather in wheat : an essay in micro-meteorology.** *Quart. J. R. met. Soc.* 1960, **86**, No. 367, 16–50, bibl. 27. [Rothamsted Exp. Sta., Harpenden]

The temperature and humidity profiles by night and day in an area of wheat 70 × 70 m and the effect on them of plant density, were investigated. Where a normal stand of wheat had been thinned by removing 3 plants out of every 4, average relative humidity was lower and the period of saturation on nights in which dew occurred was shorter than in normal or dense stands. At a height of 12·5 cm above ground the thinned crop had the highest temperature by night ; in the dense crop, temperatures were highest at midday. Near the ground within the crop, absolute wind speed tended to be constant, because the crop behaved as though it were self-sealing. The correlation between micro-climatic conditions and attack by pests and diseases is discussed.—S.M.J.

1050 Steyn, M. S. Die invloed van brakbesproeiingswater op koring en mielies in

lisimeterproewe. Deel 1. **The influence of saline irrigation water on wheat and maize in lysimeter studies. Part 1.** *S. Afr. J. agric. Sci.* 1959, **2**, No. 3, 309–27, bibl. 8, illus., French and English summaries.

Maize and wheat grown on the Karoo plateaux yielded well when irrigated to a soil depth of 4 ft. with 25 in. of water containing up to 0·3% soluble salts. Irrigation water with Ca : Na ratios of 1 : 1 to 1 : 5 resulted in better yields than that with ratios of 5 : 1 or 1 : 10, and a higher Ca and Na uptake than normal. The uptake of K was increased and the maize and wheat contained a higher Cl percentage when irrigated with saline water. Mg assimilation was inhibited. Maize grown under these conditions removed 64 lb. Mg, 48 lb. Ca, 320 lb. K and 56 lb. P/morgen/season from the soil. [1 morgen = 2·117 ac.]—F. Eng. s.—S.M.J.

1051 MONTANARI, V. La produzione granaria. [**Wheat production (in Italy).**] *Progresso agric.* 1959, **5**, No. 9, 1003–18, illus.

Information is given on the 1958–9 wheat season, as well as on wheat-growing in Italy during the past 5 years. A table shows the areas and yields of selected varieties.—E.B.O.

1052 BONFIGLIOLI, O. 3° anno di prova delle razze di grano italiane in Jugoslavia. [**Third year of trials with Italian wheat varieties in Yugoslavia.**] *Sementi elette* 1959, **5**, No. 6, 13–24, illus., English and German summaries.

An account is given of trials in 1958–9 to test Italian wheat varieties in 36 localities in Yugoslavia. Tables show the yields obtained in these trials, also the principal characteristics of the varieties. Yields obtained in wide-scale cultivation are also given. [See also *Fld Crop Abstr.* 12 : 1104.]—E.B.O.

1053 JORDAN, Hashemite Kingdom of. **Wheat trials.** *7th Ann. Rep. Deir Alla Res. Sta.* 1958, pp. 5–19.

The success of Gabo wheat after 5-yr. tests is confirmed. [See also *Fld Crop Abstr.* 11 : 863.]—M.H.

1054 JENSEN, N. F. and TYLER, L. J. **Avon wheat.** *Fm Res.* 1959, **25**, No. 2, 2–3, illus. [Cornell Univ., Ithaca, N.Y. State]

Avon soft white winter wheat is 2 in. shorter, and is less prone to lodging than Genesee. Yields of the 2 varieties are similar (42 bu./ac.), but the grain of Avon is approximately 0·4 lb. heavier per bu. than Genesee. Avon is resistant to common bunt [*Tilletia foetida*], dwarf bunt [*T. caries*] and loose smut [*Ustilago tritici*].—R.B.

1055 SCHLEHUBER, A. M. and SEBESTA, E. E. **Progress in wheat-grass breeding.** *Proc. Okla Acad. Sci. 1958* 1959, **39**, 6–16, bibl. 21, illus. [Oklahoma State Univ., Stillwater]

C.I. 13523 is a cross between Triumph wheat and *Agropyron elongatum* × *Triticum* sp. var. Kansas 464708 and is extremely resistant to leaf rust [*Puccinia rubigo-vera tritici*]. In trials in 1958 Triumph yielded 37·6 bu./ac. and C.I. 13523 42·8 bu./ac. C.I. 13523 produced grain of similar quality to that of Triumph.—R.B.

1056 LYSHOLM, M. B. " El gaucho F.A. " nueva variedad de trigo del Instituto Fitotecnico de " Santa Catalina ". [**El Gaucho F.A., a new wheat variety of the Instituto Fitotecnico de Santa Catalina (Argentina).**] *Rev. Fac. Agron., La Plata* 1959, **35**, No. 1, 31–8, English summary.

A description is given of El Gaucho, its main characteristics being : high yield of grain, resistance to rust and smut and good milling quality. It is recommended for 4 wheat sub-regions of Argentina. Tables show the yields (averages for 1954–7) of El Gaucho and other wheat varieties, with sowing dates, in these sub-regions.—E.B.O.

1057 VERMA, R. D. and BHARDWAJ, R. B. L. **Control of pohli (*Carthamus oxyacantha* Bieb) by 2,4-D.** *Indian J. Agron.* 1959, **4**, No. 1, 43–7, bibl. 6. [Indian Agric. Res. Inst., New Delhi]

C. oxyacantha is one of the most troublesome weeds in crops of wheat, gram [*Cicer arietinum*] and mustard in N. India and does not respond to cultural methods of control. It was completely controlled in a wheat crop by spraying with 2,4-D Na (at 1 lb. a.e./acre) 6 weeks after sowing the wheat. The increase in the yields of the wheat crops ranged, in different areas, from approx. 5% to 37%. Where early spraying was inadvisable, e.g. in mustard crops, the weed was controlled by spraying (at 1·5 lb. a.e./acre) after the crop had been harvested. *C. oxyacantha* was then fully grown and in flower, and 2,4-D adversely affected its seed production and seed viability. Control of *C. oxyacantha* with 2,4-D was economic.—D.B.

1058 CARTWRIGHT, W. B. and others. **Responses of resistant and susceptible wheats to hessian fly attack.** *Agron. J.* 1959, **51**, No. 9, 529–31, bibl. 5. [Purdue Univ. Agric. Exp. Sta., Lafayette, Indiana]

Hessian fly larvae (*Phytophaga* [*Mayetiola*] *destructor*) cause stunting of the second and subsequent leaves of susceptible varieties of winter wheat. In resistant varieties the second leaf is slightly stunted and the later leaves develop normally. Infested susceptible plants turn a darker green, but the colour of resistant plants remains normal. Larvae congregate 10 mm above the fourth node and in susceptible varieties develop to maturity there. In resistant varieties they die 4–5 days after hatching and are carried upward by the

growth of the second leaf beyond the protection of the first leaf sheath. In moderately resistant varieties a few larvae may survive until exposed in this way, but the primary mechanism causing the death of larvae was not revealed by this study.—J.D.J.

1059 Hulshoff, A. J. A. Een nieuwe galmug in Nederland : *Haplodiplosis equestris* (Wagner). [***H. equestris*, a new gall-midge in the Netherlands.**] *Landb Voorl.* 1959, **16**, No. 12, 707–13, bibl. 3, illus. [Plantenziektenkundige Dienst, Wageningen]

During the damp summer of 1958 severe infestations of the saddle gall midge (*Haplodiplosis equestris*) occurred in wheat and barley in some districts in southern Gelderland. Larvae were also found on *Agropyron repens*. The galls were attacked by fungi and bacteria, and in a number of fields of spring wheat yields of grain did not exceed 600 kg/ha. In 1959, the first midges appeared on 19 May and most midges emerged at the end of May. In insecticide trials in 1959, spraying with 4 l 25% DDT/ha on 19 May, and again with 2 l 25% DDT + 1 l 25% parathion on 3 June, gave the best control. Owing to dry weather, practically no secondary infection occurred and grain yields were not affected.—R.B.

1060 Ciferri, R. and Bonvicini, M. Revisione delle vecchie razze italiane in rapporto ai frumenti mediterranei. 2. *Triticum polonicum* L. e *T. turgidum* L. [**A revision of the old Italian varieties in relation to the Mediterranean wheats. 2. *T. polonicum* and *T. turgidum***.] *Ann. Sper. agr.* 1959, **13**, No. 6, 87–179, illus., English summary. [Ist. Bot. Univ. Pavia, Italy]

Descriptions are given of 85 cultivars belonging to 26 botanical varieties. [See also *Fld Crop Abstr.* 13 : 9.]—E.B.O.

1061 Petrov, M. P. and Bahteev, F. H. [**Cereal grasses of the oases in the northern foothills of Nan'šan.**] [Russian] *Izv. Akad. Nauk SSSR (Bull. Acad. Sci. USSR) Biol. Ser.* 1960, **25**, No. 1, 147–53, bibl. 10, English summary.

During an expedition (1958) to this area of Central China [approx. 99°E., 39°N.] organized by the Academy of Sciences, Chinese Peoples' Republic, nearly 400 samples of wheat and barley were collected. The material is grouped into varieties of soft wheat (*Triticum aestivum*), dwarf wheat (*T. compactum* var. *albiceps*) and barley (*Hordeum vulgare*). The study confirms Vavilov's concept that eastern and central China are the centres of origin most prolific in secondary forms of wheat and barley.—M.H.

1062 Hoshikawa, K. **Cytological studies of double fertilization in wheat** (*Triticum aestivum* **L.**). *Proc. Crop Sci. Soc. Japan* 1959, **28**, No. 1, 142–4, bibl. 15, illus. [Fac. Agric., Univ. Tokyo]

1063 Rivière, J. Contribution à l'étude de la rhizosphère du blé. [**A contribution to the study of the wheat rhizosphere.**] *Ann. Inst. nat. agron., Paris* 1959, **45**, 93–337, bibl. 319, illus.

This article consists of 2 parts : (a) a microbiological study of the wheat rhizosphere at different stages of plant growth, carried out with 2 varieties grown in pots containing 2 different types of soil ; and (b) a study of the root excretions of wheat at the end of the tillering stage, carried out with the spring var. Fylgia grown aseptically in a nutrient solution. [See also *Fld Crop Abstr.* 12 : 1669.]—E.B.O.

1064 Poluhina, I. N. [**Internode growth in wheat and rye.**] [Russian] *Doklady Akad. Nauk SSSR (Proc. Acad. Sci. USSR)* 1960, **130**, No. 5, 1152–3, bibl. 5, illus. [Timirjazev Agric. Inst.]

Internode growth in *Triticum vulgare ferrugineum* var. Moskovskaja 2453 and *Secale cereale vulgare* var. Vjatka Moskovskaja is similar in type and differs only in growth rate, that in rye being more rapid and the duration of growth more prolonged. This results in the mechanical tissue of the nodes and internodes in rye being weaker than in wheat and consequently rye is more subject to lodging.—M.H.

1065 Allerup, S. **Transpiration and water movement in young wheat plants.** *Physiol. Plant.* 1959, **12**, No. 4, 907–16, bibl. 14. [Lab. Pl. Physiol., R. Vet. Agric. Coll., Copenhagen]

An investigation was made of changes in transpiration induced in wheat plants 7–10 days old by severing the conducting tissues in air or under water at : (a) the stem near the seed, (b) the root near the seed and (c) the root 3 cm below the seed. Treatment (a) in air resulted in a sudden increase in transpiration, followed by a sharp decrease, while (b) and (c) in air were followed by sudden decreases in transpiration due to changes in root pressure. Cutting the root tissues under water resulted in a temporary decrease in transpiration, which was followed by recovery to the original level.—S.M.J.

1066 Malkani, T. J. and Shrivastava, P. R. **Lodging in wheat. On the effect of nitrogen, nitrogen plus potash, seed-rate, and depth of sowing on some morphological characters in relation to lodging in two varieties of wheat.** *Indian J. agric. Sci.* 1958, **28**, No. 1, 115–28, bibl. 32. [Indian Agric. Res. Inst., New Delhi]

Heavy applications of N (80 lb. N/acre) increased lodging in wheat (vars. N.P. 165 and N.P. 710). Addition of K at 80 lb. K_2O/acre did not significantly reduce the N-induced lodging. Depth of sowing had no effect on lodging. In N.P. 165 there was less lodging following sowing at 60 than at 100 lb./acre. Seed rate had no influence on lodging in N.P. 170. The following morphological characters were negatively and significantly correlated with lodging and can be used as indices of [resistance to] lodging : fresh and dry weight per unit length of the lowest internode ; the number of sclerenchyma cells ; and the ratio of breaking strength of the lowest internode/fresh weight of tops.—D.B.

1067 MALKANI, T. J. and others. **The effect of time of application of nitrogen on morphological characters in relation to lodging in wheat varieties.** *Indian J. Agron.* 1959, **4**, No. 1, 23–35, bibl. 12. [Indian Agric. Res. Inst., New Delhi]

Experiments described in *Fld Crop Abstr.* 11 : 34 and the previous abstract were continued with special reference to time of application of N and lodging in wheat. N was applied at sowing and 35, 70 and 105 days later. Whenever applied, N increased lodging, but the later applications (70 days) resulted in less intense lodging than the earlier applications at sowing or 6 weeks later. Early application of N increased the shoot/root ratio and decreased the weight per unit length and the breaking strength. For determining lodging resistance of varieties it is recommended that both shoot/root ratio (a positive correlation) and breaking strength/weight of tops (a negative correlation) should be used and determined at maturity.—D.B.

1068 CARLES, J. and others. Nouvelles recherches sur les facteurs physiologiques de la verse du blé et sur sa liaison avec le déséquilibre glucides/protides. [**Further investigations into the physiological factors of lodging in wheat and on its connexion with an unbalanced carbohydrate/protein ratio.**] *C.R. Acad. Agric. Fr.* 1959, **45**, No. 12, 595–602, bibl. 3.

The results from the investigations described, carried out near Toulouse, France, in 1958–9 confirmed the conclusions drawn from investigations in 1957 [see *Fld Crop Abstr.* 11 : 932]. A device was introduced in 1958 by which it was possible to reduce during sunny days the amount of light received by plants of the wheat var. Étoile de Choisy grown in the field either with no N fertilizer or with 60 kg/ha. It was found that however fragile and prone to lodge the wheat plants were, they would not usually lodge unless there was a storm. In lodged plants the ratio of weights of aerial parts/roots was 37% higher than in normal plants. From determinations made on fully developed internodes, the carbohydrate/N ratio was 11·7 for normal standing plants and 3·4 for lodged plants.—E.B.O.

1069 SKRIPČINSKIĬ, V. V. [**Peculiarities in the development and resistance to cold of certain spring wheats in relation to their photoperiodic reaction.**] [Russian] *Doklady Akad. Nauk SSSR (Proc. Acad. Sci. USSR)* 1960, **130**, No. 4, 932–5, bibl. 22. [Stavropol Agric. Inst.]

From a test with 4 wheat varieties, namely, the winter type Lutescens 0329 and the 3 spring types Milturum 0321, 553 and Lutescens 062, it is concluded that the greater the retardation of the development of the spring types under the influence of short autumn days, the greater their frost resistance.—M.H.

1070 STROUN, M. and PUGNAT, C. Action de l'hivernage sur le blé tendre de printemps " Lichti-früh " (*Triticum vulgare*). [**The effect of overwintering on spring wheat var. Lichtifrüh.**] *Ber. schweiz. bot. Ges.* 1959, **69**, 5–15, bibl. 32, illus. [Univ. Genève]

The object was to find out if spring wheat could be transformed into winter wheat when growing in a temperate climate with fluctuating temperatures during a season as distinct from a continental climate. The spring variety Lichtifrüh was sown in autumn in 2 consecutive seasons and overwintered. Its light requirements became modified to those of the winter type ; its temperature requirements were unchanged. The resulting plant had the properties of an ' alternative ' cereal. F. s. —D.B.

1071 RUMI, Clara P. Influencia de la vernalización y del ácido indol-acético en el período vegetativo de trigos. [**Influence of vernalization and indole-acetic acid on the vegetative period of wheat.**] *Rev. Fac. Agron., La Plata* 1959, **35**, No. 1, 15–23, bibl. 11, English summary.

Before sowing, germinated seeds of the wheat varieties Buck Necochea (spring or semi-spring type) and Sinvalocho (spring type) were subjected to low temperature (2·5–3°C.) and/or treated with IAA. The cold treatment shortened the vegetative period of wheat ; the reduction was 20% in the case of Sinvalocho treated for 60 days, and 15% in the case of Buck Necochea treated for 30 days. Treatment with IAA shortened slightly the vegetative period of Buck Necochea (6·3% reduction at a concentration of 100 ppm., corresponding to 0·05 mg of IAA absorbed per g of seed), but had no effect on Sinvalocho, even at higher concentrations. The effects of vernalization and IAA treatment were cumulative ; the maximum reduction of the vegetative period (22%) was obtained with

Buck Necochea by cold treatment for 30 days plus treatment with IAA at 100 ppm., while the reduction obtained with cold alone was 15% and with IAA alone 6·3%.—E.B.O.

1072 Rumi, Clara P. and Rivoir, O. R. Variaciones bioquímicas relacionadas con el desarrollo en trigo. [**Biochemical variations in relation to development in wheat.**] *Rev. Fac. Agron.. La Plata* 1959, **35**, No. 1, 65–78, bibl. 19, English summary.

The metabolic changes which take place in the tissues of annual plants during the course of their development are directly or indirectly responsible for the passage from the vegetative to the reproductive stage. A knowledge of these changes, and of the internal and external factors which determine them, will help to control them, with obvious practical consequences. Plants of the winter wheat varieties Kanred and Guatraché were subjected to 3 treatments : (a) vernalization followed by continuous light ; (b) vernalization only ; (c) no treatment. All treatments ended on the same date. After a subsequent period under short day and high temperature, the apical primordia were examined. These were in the vegetative stage in all 3 groups of Kanred and in groups (b) and (c) of Guatraché. Group (a) of Guatraché flowered and eared. Dry matter, protein content and auxin activity were determined in the plant tops. Percentage of dry matter was higher, and percentage of protein was lower in (a) than in (b) and (c). The ratio of non-protein/protein was 3·7, 2·5 and 2·4 for Kanred and 5, 2·1 and 2·6 for Guatraché, respectively. No significant differences were observed in auxin activity. These findings are discussed and the following conclusion is drawn : before vernalization the plants had an active metabolism which resulted in rapid growth ; after vernalization but before the photophase, the metabolic activity was reduced and growth was slower ; under continuous light, the non-protein synthesis was greater than the protein synthesis, the result being an increase in the ratio between these 2 types of substances. This ratio remained constant before and after vernalization in plants kept under short days.—E.B.O.

1073 Abolina, G. I. [**The significance of certain factors for the formation of grain in different parts of the ear of spring wheat.**] [Russian] *Izv. Akad. Nauk SSSR. (Bull. Acad. Sci. USSR) Biol. Ser.* 1960, No. 2, 287–90, bibl. 3.

The study was made to determine the effect on grain filling of varying the water supply to different parts of the ear by reducing the number of florets in the ear and by removing the upper leaves and branches at flowering. It is concluded that absolute grain weight is not determined directly by water content of the grain, but by various factors which operate at a phase of growth before flowering.—M.H.

1074 McDonough, W. T. **The significance of the awns of durum wheat as suppliers of photosynthate to the developing kernels.** *Diss. Abstr.* 1959, **20**, No. 1, 47. [Univ. Maryland]

In studies using $^{14}CO_2$ as a tracer, the awns of durum wheat were more efficient suppliers of photosynthate to the kernels than were the flag leaves. The awns were estimated to be responsible for 12% of the total kernel dry weight accumulated during the period from the 2nd to the 4th week after heading. Almost all this accumulated dry weight was starch.—P.J.B.

1075 Iqbal, M. **The phosphorus composition of wheat grain as influenced by residual phosphate treatments.** *Diss. Abstr.* 1959, **20**, No. 1, 17–18. [Univ. Illinois, Urbana]

1076 Bodo, G. Über die Zusammensetzung des Weizeneiweisses bei verschieden hohen N-Gaben. [**The composition of wheat protein at different levels of applied nitrogen.**] *Qual. Plant. et Materiae veg.* 1960, **6**, Nos. 3–4, 337–45, bibl. 10. [Biol. Lab. Österr. Stickstoffwerke A.G., Linz/Donau, Austria]

Hubertus winter wheat, sown in autumn 1956, was given 136 kg P_2O_5 and 225 kg K_2O/ha at sowing and 40, 80, 120, 160 or 200 kg N/ha in 2 (40 kg N/ha only) or 3 (all rates except 40 kg N) applications in 1957. Austro Bankut winter wheat sown in autumn 1957 was given 150 kg P_2O_5/ha and 225 kg K_2O/ha at sowing and 40, 80, 120 or 160 kg N/ha in 1958 in 2 or 3 applications. In both varieties, increasing rates of N increased to a small extent the proportion of proline and glutamic acid in the grain protein and decreased that of lysine and arginine.—R.B.

1077 Gachon, L. Diagnostic foliaire des céréales et détermination rationnelle de la fumure. [**Foliar diagnosis of cereals and a rational determination of manuring.**] *Ann. agron., Paris* 1959, **10**, No. 3, 309–26, bibl. 21, English, German and Russian summaries. [Centre Rech. Agron., Massif Central, Clermont-Ferrand, France]

The foliar diagnosis of wheat and barley was studied during 6 years in pot trials characterized by different soil profiles, and in field trials with different manurial treatments. Results showed that the chemical composition of the leaves, mainly their N content, was influenced by the nature of the subsoil, the presence of a water-table and, generally, by all physical factors affecting the water availability to the plant. It is, therefore, concluded that foliar diagnosis is useful for determining the requirements of plants, but its interpretation must take account of the physical characteristics of the environment.—E.B.O.

1078 Boldyrev, N. K. [**The quality of yield from spring wheat and its evaluation**

on the basis of the N content in the leaves.] [Russian] *Fiziol. Rast. (Pl. Physiol., USSR)* 1959, **6**, No. 1, 73–81, bibl. 28, English summary. [Dep. Agrochem., Kirov Agric. Inst., Omsk, USSR]

[See also *Fld Crop Abstr.* 12 : 1678.] The present work is concerned with the interdependence between N content of the leaves and the conditions of plant nutrition on the one hand and the relative N content in the leaves and grain on the other. A direct relationship has been established, with a high coefficient of correlation (0·9–1·0), between the N content in the upper wheat leaves at the flowering phase and N in the grain at full ripeness. The coefficient for reducing the total N in leaves to N content of the grain is 0·96 for Lutescens 62, 0·93 for Hordeiforme 10, and 0·90 for Milturum 553. F. Eng. s.—M.H.

1079 PETINOV, N. S. and PAVLOV, A. N. [**The participation of the glumes of the wheat ear in N absorption under foliar nutrition.**] [Russian] *Doklady Akad. Nauk SSSR (Proc. Acad. Sci. USSR)* 1960, **130**, No. 4, 929–31, bibl. 4. [Timirjazev Inst. Pl. Physiol., Acad. Sci. USSR]

This work extends that recorded in *Fld Crop Abstr.* 11 : 472.—M.H.

1080 HOLMES, J. C. and others. **Rates of nitrogen for winter wheat in south-east Scotland.** *Scot. Agric.* 1959, **39**, No. 3, 137–40, bibl. 3. [Edinburgh Sch. Agric.]

Sixteen trials were conducted with 5 varieties of winter wheat at 6 locations during 4 years. Nitro-chalk was applied at 0, 1, 2, 3 and 4 cwt./acre in mid-May. Best returns were obtained from an application of 3 cwt. nitro-chalk/ac., which resulted in yields 6·8 cwt. greater than from control plots receiving no fertilizer. The protein content of the grain was also highest at this rate. These results were consistent for wheat following potatoes, but after permanent pasture, N applications were unnecessary.—J.D.J.

1081 WARING, S. A. and TEAKLE, L. J. H. **Fertility investigations on the black earth wheatlands of the Darling Downs, Queensland. 3. Mineral nitrogen in the soil and its relation to the wheat crop.** *Aust. J. agric. Res.* 1960, **11**, No. 1, 27–41, bibl. 13. [Dep. Agric., Univ. Qd, Brisbane]

The level of mineral N in soil under fallow and wheat was measured at depths of 0–4 ft. during 1951–3. Relationships between mineral N at sowing and yield and N content of wheat grain and straw were examined. At the end of the fallow period, values for nitrate N ranged from 10–20 μg/g in the top 2 ft. and from 0–10 μg/g at the 2–4 ft. levels. Values for ammonia N were mainly in the range 0–3 μg/g. Under the growing crop, mineral N declined at most depths during the period from sowing to Sept. or Oct., after which there was little further change before harvest. Except for 2 groups of sites, uptake of mineral N was normally greatest from the top 2 ft. of soil. Excluding one site, mineral-N content to a depth of 4 ft. at sowing averaged 126 lb./ac., and 63 lb./ac. was recovered in the grain and straw of crops sown in May–June. Correlations between mineral N at sowing and grain yield indicated that N was not an important factor limiting yield. [See also *Herb. Abstr.* 11 : 1813 and 12 : 1093.] F. s.—S.M.J.

1082 HARPER, H. J. **65 years of continuous wheat.** *Bull. B-531 Oklahoma agric. Exp. Sta.* 1959, pp. 38, illus.

Virgin prairie on P-deficient loam soil near Stillwater, Oklahoma, was ploughed in 1892 and sown annually to winter wheat until 1957. Average yields of unmanured wheat over the 65-year period were 12·6 bu. grain/ac. Plots receiving 3·5 tons f.y.m./ac./yr. for 59 years yielded 20·5 bu./ac. ; during this period, 7 out of the 59 crops were uneconomic compared with 20 uneconomic crops out of 65 on unmanured land. Plots receiving 30 lb. P_2O_5/yr. as superphosphate for 27 years yielded 18·6 bu./ac. F.y.m. + P_2O_5 had little more effect on yields than f.y.m. alone. $NaNO_3$ at 100 lb./ac./yr. between 1930 and 1945, and NH_4NO_3 at 100 lb./ac./yr. between 1946 and 1957, did not produce economic increases in grain yields. Winter growth of wheat and yields of straw were improved by superphosphate or f.y.m. Superphosphate applications increased net income per acre by 90%. F. s.—R.B.

1083 CROPSEY, M. G. and WIANT, D. E. **The effect of cathode ray irradiation on the respiration rate, milling tests, and baking properties of wheat.** *Quart. Bull. Mich. agric. Exp. Sta.* 1959, **42**, No. 1, 164–75, bibl. 27, illus.

Experiments were conducted to determine : (a) if cathode ray irradiation would prevent spoilage of damp wheat grain by killing moulds on the surface of the grain and within the seed coat, and (b) the effect of irradiation on milling and baking quality. Hard red spring wheat was irradiated with various levels of cathode rays. Treatment with over 500,000 rep reduced the respiration rate of slightly damp wheat (15–17% moisture content on a wet weight basis) to a level comparable with that of wheat of low moisture content (10%). The milling and baking tests showed that a burnt odour and taste developed after irradiation at 900,000 rep. F. s.—A.M.H.

OATS

See also Abs. 1495.

1084 GRIFFITHS, D. J. **The oat crop.** *Quart. Rev. N.A.A.S.* 1959, **10**, No. 44, 139–47, bibl. 6. [Welsh Pl. Breed. Sta., Aberystwyth]

In the last 15 years barley has been replacing spring oats in arable areas. In livestock areas, oats are still valued for their straw as well as grain. Progress in breeding winter oats for short straw, winterhardiness, and resistance to stem eelworm and mildew is described. The breeding of spring oats for short straw under high fertility conditions and for resistance to mildew is also described, and the problems of poor upland soils and frit fly [*Oscinella frit*] are discussed. The importance of sowing spring oats early is stressed.—J.D.J.

1085 Hayes, J. D. **Spring grazing of winter oats.** *J. agric. Soc. Univ. Coll. Wales* 1959, **40**, 25–30, bibl. 3. [Welsh Pl. Breed. Sta., Aberystwyth]

Winter oats var. Powys (S226) gave spring grazing and also a full crop of grain, with reduced risk of lodging, provided that grazing stopped before flower primordia were removed in the process (late March or early April) and also provided that a top dressing of N was given after grazing.—J.D.J.

1086† Hoveland, C. S. **Defoliation of oats and pearl millet as related to herbage yield.** *Diss. Abstr.* 1959, **20**, No. 1, 17. [Univ. Florida, Gainesville]

In trials in Florida during the winters of 1955–7, Arlington, Floriland and Seminole oats with decumbent, intermediate and erect growth habits, respectively, and grown under irrigated or non-irrigated conditions, were cut to heights of 9, 5 or 2 in. when they reached plant heights of 18, 12 or 6 in. Decumbent plants were lifted into an erect position before cutting. Cutting when the plants were 6 in. high markedly decreased dry-matter yields. Yields were highest where the plants were cut when 12 in. high, except for Seminole, which gave the highest yields when cut at 18 in. high. Clipping to a height of 2 in. did not directly reduce forage yields, but caused severe stand losses. In a second series of experiments during 1955–8, pearl millet (*Pennisetum glaucum*) plants were cut when 54, 30, 18 or 12 in. high to heights of 18, 10, 6 or 4 in. Plants grown in rows 38 in. apart and cut when 54 in. high produced the most dry matter, though yields of plants grown in rows 7 or 19 in. apart and cut when 30 in. high were almost as great. With plants cut when 30 in. high, stubble height had little effect on total dry-matter production at low levels of N supply ; with relatively heavier rates of N supply, cutting to a height of 10 in. resulted in highest dry-matter yields. With pearl millet, total dry-matter production was highest from sowings made in March and April.—P.J.B.

1087 Boldin, D. T. [**A new oat variety Artemovskiĭ 107.**] [Russian] *Selek. Semenovod.* (*Select. Seed Prod.*) 1960, **25**, No. 1, 30.

This variety was produced at the Stalinsk [formerly Novokuznetsk] State Agricultural Experiment Station and it has been included in the varietal trials of the southern Ukraine. It showed special promise in the Dnepropetrovsk area where yields exceeded those of the standard oat, Sovetskiĭ, by 200–400 kg/ha. Average grain yield was 2600–3100 kg/ha.—M.H.

1088 Department of Agriculture, Cyprus. [**Cereals.**] *Rep. Dep. Agric. Cyprus 1958*, 1959, p. 42.

In a yield trial with oats, the varieties Précoce du Maroc from Morocco and Orient from Australia yielded more than the local oat varieties. Preliminary results from a rotation trial at Morphou under dryland conditions showed that the 3-year rotation, wheat/barley/legume (grazed) was the most economical.—E.B.O.

1089 Schmidt, J. and Dreier, A. F. **New oat variety for Nebraska.** *Nebraska Exp. Sta. Quart.* 1959, **6**, No. 1, 10, 11, 16, illus.

In comparison with Nemaha and Cherokee oats, Nehawka has lighter-coloured foliage, is somewhat shorter, has more open panicles and is higher yielding. It is more resistant to lodging than Nemaha and heads 1 day earlier. Yields of grain are similar to those of Andrew. Nehawka is suitable for dryland cultivation in all districts of Nebraska except the N.E. and E. central districts.—R.B.

1090 Chamberlain, R. and Willis, R. J. **Prevention of tulip root in oats.** *Mon. Rep. Minist. Agric. N. Ire.* 1960, **34**, No. 11, 333–6.

Experiments were carried out in N. Ireland from 1956–8 to compare the resistance of oat varieties to tulip-root eelworm (*Ditylenchus dipsaci*). Milford (resistant) and Sandy (susceptible) oats were grown on land heavily infested with *D. dipsaci*. In the 1st harvest year, Milford yielded 15 cwt. grain and 40 cwt. straw/ac., while Sandy yielded only 8·75 cwt. grain and 16·25 cwt. straw/ac. In the 3rd harvest year Milford yielded 16·5 cwt. grain and 37 cwt. straw/ac. and Sandy yielded 4·75 cwt. grain and 20·5 cwt. straw/ac. In further trials in 1959 (on the same plots) the spring-oat variety Early Miller also showed a high degree of resistance to *D. dipsaci*.—S.M.J.

1091 Langille, W. M. and Mahoney, J. F. **Note on boron toxicity in oats.** *Canad. J. Pl. Sci.* 1959, **39**, No. 3, 401, bibl. 3. [Nova Scotia Dep. Agric. Mktg, Truro]

Symptoms of B toxicity appeared in a crop of oats undersown with Ladino clover, which had been given 35 lb. borax/ac. Many of the seedlings were chlorotic at first, but reverted to a normal colour as the crop developed. The soil in which

chlorotic plants were growing contained 1·41 ppm. soluble B, while soil from the same plot supporting non-chlorotic plants contained 0·84 ppm. B, and soil from untreated areas contained 0·36 ppm. B. The borax dressing had no effect on grain yields.—R.B.

1092 Reisener, H.-J. Untersuchungen über den Phototropismus der Hafer-Koleoptile. [**Phototropism in the oat coleoptile.**] *Z. Bot.* 1958, **46,** No. 5–6, 474–505, bibl. [Bot. Inst. Tübingen, W. Germany]

1093 Wiggans, S. C. **Responses of oat plants to various percentages of continuous shade.** *Bot. Gaz.* 1959, **121,** No. 1, 55–60, bibl. 11. [Iowa agric. Exp. Sta., Ames]

Andrew oats were sown at 3 bu./ac. in 1956, and Andrew and Cherokee oats at 0·5 bu./ac. in 1957, and shaded to intercept 0, 50, 75 or 90% of full light intensity. The interval between sowing and harvest was increased by 3 days with 50% shading and by up to 27 days with 90% shading. The height of oat plants at maturity was slightly increased by 50% and 75% shading, and significantly reduced by 90% shading. Yields of grain were not significantly affected by 75% shading in 1957 or by 50% shading in either year. More intense shading significantly reduced grain yields. Shading significantly reduced yields of dry matter from the aerial parts of the plants, but had little effect on 1000-grain weight.—R.B.

1094 Williams, P. C. **Studies on phytin and related compounds in cereals with special reference to oats.** *Thesis for Ph.D.* [Abstr. cont. in] *J. agric. Soc. Univ. Coll. Wales* 1959, **40,** 48.

Phytate phosphorus comprises about 62% of the total P in mature grain. Maturation is accompanied by gradual synthesis of phytin, whereas in germination this process is reversed. F. s.—S.M.J.

1095 Eberbardt, W. and Krzysch, G. Der Einfluss der Wasser- und Nährstoffversorgung auf den Spelzengehalt einiger Hafersorten. [**Influence of water and nutrient supply on the husk content of some oat varieties.**] *Z. PflErnähr. Düng.* 1959, **86,** No. 2, 111–20, bibl. 12. [Inst. Acker- u. PflBau, Techn. Univ. Berlin- Charlottenburg, W. Berlin]

The influence of variety, moisture, manuring and soil on the husk content of 7 varieties of oats was investigated. Soil had no influence. Among the varieties studied, Ebstdorfer Braun and Eckendorfer Frühhafer Borriesa were above the mean in husk content while Carstens Hafer VII and Firlbecks Gelb were below it. Increased water supply resulted in a higher husk content caused by a lower 1000-grain weight. With increasing supplies of NPK the husk content became lower. The decrease was caused, in presence of an insufficient water supply, by better development of the caryopsides and, with an abundant water supply, by the formation of a finer, thinner husk.—D.B.

RYE

See also Abs. 1064.

1096 Caso, O. H. and others. **Effect of gibberellic acid on flower differentiation in Petkus winter rye.** *Nature, Lond.* 1960, **185,** No. 4711, 477–9, bibl. 8, illus. [Bot. Div., Calif. Inst. Tech., Pasadena]

Under conditions of the tests, spraying the plants with water solutions of gibberellic acid (200 ppm.) before the 10th-leaf stage inhibits flowering. This is attributed to the acid either preventing florigen formation or destroying it. The significance of the facts in regard to vernalization is outlined.—M.H.

1097 Purvis, O. N. **Effect of gibberellin on the flower initiation and stem extension in Petkus winter rye.** *Nature, Lond.* 1960, **185,** No. 4711, 479, bibl. 3. [Agric. Res. Council Unit Pl. Physiol., Imp. Coll. Sci. Tech., London, S.W.7.]

From tests in which the unvernalized rye plants were injected with gibberellic acid (20 ppm.) through leaves of different age, effects were obtained similar to those recorded by Caso *et al.* (previous abstract). It is concluded that gibberellin treatment cannot replace low temperature for flower induction in this rye variety ; the accelerating effect on flowering appears to operate at some post-inductive stage. A stimulus to stem extension by gibberellin occurs either just before or after flower initiation has taken place.—M.H.

1098 Napp-Zinn, K. Über den Einfluss von KH_2PO_4 auf die Vernalisation. [**The effect of KH_2PO_4 on vernalization.**] *Z. Bot.* 1958, **46,** No. 5–6, 506–15, bibl. 9. [Bot. Inst., Univ. Köln, W. Germany]

Ear emergence occurred earlier in plants of Petkuser winter rye and wheat (2 varieties) which had grown from caryopsides which had imbibed solutions of KH_2PO_4 than from caryopsides which had imbibed pure water. F. Eng. s.—D.B.

1099† Morris, H. D. and Jackson, J. E. **Source and time of application of nitrogen for rye forage.** *Proc. Soil Sci. Soc. Amer.* 1959, **23,** No. 4, 305–7, bibl. 6. [Univ. Georgia, Athens]

Wren's Abruzzi rye was sown in 1954–6 in Oct. or early Nov. following cotton and was given (a) 120 lb. N/ac. at sowing, (b) 60 lb. N/ac. at sowing and again in Feb., (c) 30 lb. N/ac. at sowing and in Feb., or (d) 90 lb. N/ac. at sowing and

30 lb. N/ac. in Feb. Treatments (b) and (d) yielded approximately 230 lb. forage dry matter/ac./yr more than treatment (a). Forage yields up to 15 Feb. were approximately 109 lb./ac. greater in treatments (a) and (d) than in treatment (b).—R.B.

BARLEY

See also Abs. 1059, 1061, 1077, 1395.

1100 Société d'Encouragement de la Culture des Orges de Brasserie et des Houblons en France. Rapports sur la campagne 1957. [**Report for the season 1957.**] [n.d.], pp. 79. [Received Aug., 1959]

An account is given of trials with varieties of malting barley in various regions of France. Of the varieties mostly grown, Beka had the highest extract (80·6%), highest 1000-grain weight (42·1g) and 10·9% protein content. [See also *Fld Crop Abstr.* 12 : 59.]—E.B.O.

1101 Estación Experimental de Aula Dei, Spain. [**Barley.**] *Inf. Esta. exp. Aula Dei 1957-8* [n.d.], pp. 4–6, 10–12 and 14.

The barley variety Albacete 1, which yields well without irrigation, is being multiplied. The varieties Ricla 2a and Compacta 4, which outyielded La Almunia under irrigation, are being multiplied for cultivation on the irrigated lands of Aragon.—E.B.O.

1102 Barley Committee European Brewery Convention. **Ninth Report. Trials 1958.** Rotterdam, 1959, pp. 136.

The results are given of trials in 15 European countries in which the barley varieties Beka, Ingrid, Union and Wisa were compared with Kenia. Other varieties were sown in some of the trials. Samples from the various trials were malted and subjected to chemical analysis and, in many cases, to small-scale brewing tests. The weather in 1958 was unusually bad in most European countries, and it affected adversely the quality of barley. Only 4 of the trials gave barleys with a N content suitable for malting. Of the varieties tested, Union, Ingrid and Wisa yielded best. The grain of Beka had the best appearance. Union and Wisa showed pronounced dormancy in many of the trials. Beka, Union and Wisa gave high malt extracts. [See also *Fld Crop Abstr.* 12 : 605.]—E.B.O.

1103 Swanson, A. F. **Production and utilization of barley and malt in Peru.** *Spec. Rep. 2 PCEA* [n.d.], pp. 8, illus. [La Molina Agric. Exp. Sta., Lima, Peru] [Received Jan., 1960]

1104 Allerup, S. **Respiration in water imbibing barley caryopses.** *Physiol. Plant.* 1959, **12**, No. 1, 118–23, bibl. 14.

The gas exchange quotient, GQ, was determined for water-imbibing barley caryopsides under the following conditions : (a) caryopsides with husks attached, (b) husks removed, (c) isolated embryos. In all cases the GQ maximum occurred when the water content of the caryopsides was 50–55% on a dry matter basis, but was highest in (a) where, because of the thin layer of water between seed and husk, there was less differentiation between O_2 and CO_2 diffusion.—S.M.J.

1105 Hamy, A. Carence en acide phosphorique et concentration en pigments solubles. [**Phosphoric acid deficiency and concentration of soluble pigments.**] *Ann. agron., Paris* 1959, **10**, No. 4, 455–75, bibl. 8, English, German and Russian summaries. [Sta. Agron., Châteauroux, France]

An account is given of pot- and field-trials in which the concentration of soluble pigments in different parts of young barley plants was studied. Their concentration was influenced principally by the content of phosphoric acid in the soil. When the soil moisture increased, the dry weight and the concentration of phosphoric acid in the plant increased, while the concentration of soluble pigments decreased. An application of N fertilizer increased the dry weight, but reduced the concentration of phosphoric acid in the plant and the colour intensity of the extract.—E.B.O.

1106 Zavadskaja, I. G. and Skazkin, F. D. [**Microsporogenesis in barley with deficient soil moisture and application of nitrogen at different developmental periods.**] [Russian] *Doklady Akad. Nauk SSSR (Proc. Acad. Sci. USSR)* 1960, **131**, No. 3, 692–4, bibl. 16. [Leningrad State Pedagogic Inst.]

The authors' experiments made during 1954–8 with the 2-rowed barley variety Viner show that an inadequate supply of water in the soil at the time of the formation of the generative organs (as well as at the critical period) lowers grain yield. It is therefore concluded that the critical period orginates not at the time of pollen-mother-cell initiation, but at the preparation for meiosis when reduction division begins. Thus sensitivity to water deficiency is related to the plant's transition to the gametophyte generation, the beginning of which corresponds to the first reduction division, i.e. the haploid generation. If N is applied at this stage in amounts optimum for the soil concerned, resistance of the crop to water deficiency is enhanced. [See also *Fld Crop Abstr.* 12 : 1797.]—M.H.

1107 Domański, R. Wpływ suszy na plon jęczmienia jarego. [**The influence of drought on spring barley.**] *Acta agrobot.* 1958, **7**, 35–46, bibl. 10, English summary. Seen March, 1960.

During 1952–4, pot trials were carried out at the Poznán School of Agriculture to determine the response of spring barley to phosphatic fertilizers applied in various doses at different stages of plant growth under drought conditions. The data showed : (1) drought always caused a reduction in grain yield, regardless of the stage of growth at which water starvation occurred, and was most damaging at the shooting stage ; (2) a deficiency of water produced an increase in protein content of the grain, which was greatest when drought occurred at the shooting stage, less when at ear formation, and least when at tillering ; (3) plants with an abundant supply of P were more resistant to the effects of water deficiency. F. Eng.s.—M.H.

1108 Dománski, R. Wpływ dokarmiania azotem na plon jęczmienia jarego. [**Influence of N fertilizers on spring barley.**] *Acta agrobot.* 1958, **7**, 27–34, bibl. 7, English summary.

Pot trials have shown that the best time to apply N fertilizer is at the " spreading " stage. Under field conditions, however, the N fertilizer does not penetrate the soil as rapidly as in pots and fertilizing at that stage has less effect on increasing the vegetative mass, with the result that the risk of lodging is reduced. N fertilizers should be applied to barley when grown for feed, and not for seed. F. Eng. s.—M.H.

1109 Kreyger, J. Onderzoek betreffende het bewaren van brouwgerst. [**Investigations concerning the storage of malting barley.**] *Internat. Tijdschr. Brouw. Mouterij* 1959, **18**, No. 3, 75–99, English, French and German summaries. [Inst. Bewar. Verwerk. LandbProd., Wageningen, Netherlands]

The effects of storage periods of up to 35 weeks at temperatures of 7°–30°C. on germination and other properties of malting barley was investigated during 1957–8. Stored barley used for malting was required to give 95% germination during a 3-day germination period. Barley containing 14% moisture could be successfully stored for at least 30 weeks at temperatures of 20°C. or below. Drying was preferable to cool storage when the grain contained more than 19% moisture. Growth of moulds occurred only when barley contained more than 18% moisture and when the germinating capacity had fallen below the required level. Air-tight storage and storage in an atmosphere of nitrogen had no advantages over storage in air.—R.B.

MAIZE

See also Abs. 1050, 1337.

1110 Peterson, A. E. and Engelbert, L. E. **Growing corn in Wisconsin without plowing.** *Trans. Wis. Acad. Sci.* 1959, **48**, 135–40, bibl. 5. [Wisconsin Agric. Exp. Sta., Madison]

Mulch tillage, using a mulch planter, was compared with conventional seedbed preparation in a 4-yr. trial with maize at 3 locations. Fertilizer (800 lb. 10–10–10 [NPK]/ac.) was drilled 7–9 in. deep in the mulch treatment, and broadcast and ploughed-in in the other treatment. All plots received 300 lb./ac. 4–16–16 (NPK) or 5–20–20 (NPK) drilled near the maize rows, and a side-dressing of NH_4NO_3 at 250–300 lb./ac. Yields from plots in the better maize-growing areas were approximately equal in both treatments, but in N. Wisconsin mulch tillage reduced yields to some extent. In 1954, heavy rain eroded 10·3 tons soil/ac. from ploughed plots, but had no effect on mulched plots. Rodents and pheasants caused more damage to maize on mulched than on ploughed land.—R.B.

1111 Phillips, R. E. **Soil compaction and corn growth.** *Diss. Abstr.* 1959, **20**, No. 3, 820. [Iowa State Coll., Ames]

In field trials on Colo clay, maize growth and grain yields were significantly reduced by soil compaction obtained by repeatedly running a tractor over the soil. In laboratory trials, maize growth was linearly related to the degree of impedance to root growth offered by the soil, as indicated by values for bulk density (over the range 0·94–1·3 g per ml) and needle penetrometer readings.—P.J.B.

1112 Department of Agriculture, Nyasaland. **A summary of some aspects of agricultural experimental work, 1958-59. Maize.** [Cont. in] *Nyasaland Fmr Frstr* 1959, **5**, No. 1, 5–6.

Population trials with maize in Nyasaland showed that a stand of 10–15 thousand plants/ac., obtained by sowing 3 seeds/hill and replacing non-germinated seed in the first week after germination, resulted in the best yields. The yield of maize hoed 3, 4 and 5 weeks after germination was 98, 83 and 55% of the yield obtained when the crop was hoed 2 weeks after germination. Preliminary trials with 2,4-D and MCPA indicated that a pre-emergence spray + cultivation in Jan. to earth up the maize was adequate for weed control.—S.M.J.

1113 Golubev, M. S. [**The effect of stimulators on maize.**] [Russian] *Priroda, Moskva (Nature, Moscow)* 1960, **48**, No. 3, 111–12.

On experimental plots located in Juhnov, Kaluga Province [55°N., 35°E.] an unknown variety of maize was sown to determine the effect of treating the grain with an aqueous solution of potassium bromide (concentration 3 : 1000). The grain was warmed, then soaked in the solution for 8 hr. and dried in shade before being sown. On the plots sown with treated grain, seedlings appeared

2–3 days earlier than the control ; cobs appeared 5 days earlier and the total cob weight was 15% greater than that of the control. The acceleration of development in maize is of importance in the Kaluga Province where frost occurs in late Aug. or early Sept.—M.H.

1114† Schroder, C. A. **Summer maize and winter pasture under irrigation.** *Qd agric. J.* 1959, **85,** No. 11, 689–98, illus.

At the Gatton Regional Experiment Station in the Lockyer Valley, where annual rainfall averages 29 in., a Yarloop subterranean clover pasture was lightly ploughed and cultivated and then sown with maize in 4- or 6-ft. rows. Irrigation was given when required, but totalled only 17·2 in. in the 1st year. In the 2nd yr. NPK fertilizer was applied to plots. Yields of 22 and 15 tons silage/ac. were obtained from maize grown in rows 4 and 6 ft. apart, respectively, without retarding the growth of the clover. Clover in plots where maize was cut for silage recovered well and yielded 5 and 3 tons green weight/ac. at the 6- and 4-ft. row widths, but yields were reduced to only 3 and 0·6 tons/ac., respectively, where maize was allowed to mature for grain.—S.M.J.

1115 Kretschmer, A. E., Jr. **Selection, breeding and cultural investigations of field corn and small grains as sources of livestock feeds in South Florida.** *Ann. Rep. Fla agric. Exp. Stas* 1958, 294–5.

In maize trials at Fort Pierce in 1957, Funk G-740, Cueto 56, Corneli 54, Funk G-737A and Dixie 18 yielded 87, 80, 75, 66, 64 and 63 bu. grain/ac., respectively. Cueto 56 and Corneli 54 showed the greatest resistance to *Helminthosporium turcicum.* Corneli 54 sown in rows 42-in. apart and thinned to 7, 9, 11 and 13 in. apart in the row yielded 77, 68, 69 and 62 bu./ac., respectively.—R.B.

1116 Lascols, X. Sélection réciproque et maïs hybrides précoces franco-américains. [**Reciprocal selection and early French-American maize hybrids.**] *Ann. Amélior. Pl., Paris* 1959, **9,** No. 3, 377–401, bibl. 8, illus., English, Russian and German summaries. [Sta. Cent. Amélior. Pl., Versailles, France]

Information is given on the new early French-American hybrids INRA 200, INRA 244 and INRA 258, also on the Dutch hybrid C.I.V.7, which are widely grown in France and yield about 15% more grain than the American hybrids of the same earliness (W 240 and W 255).—E.B.O.

1117 Parker, C. and Ashby, D. G. **Recent work on control of weeds in maize.** *Proc. Afr. Weed Contr. Conf. S. Rhodesia July 1958* [n.d.], 66–71, bibl. 1.

CP 18–15 used at rates as low as 0·5 gal./ac. suppressed growth of *Datura ferox* and *D. stramonium* for 6–12 weeks according to rainfall conditions, and a rate of 0·66 gal./ac. suppressed *Xanthium pungens.* A single pre-emergence application of CP 18–15 to maize selectively controlled annual grasses and all important dicotyledonous weeds (excluding *Striga asiatica,* but including *Datura* spp. and *X. pungens*). Under conditions of erratic rainfall CP 18–15 was more reliable than 2,4-D.—S.M.J.

1118 Ivens, G. W. **Preliminary trials with simazin as a pre-emergence herbicide in maize.** *Proc. Afr. Weed Contr. Conf. S. Rhodesia July 1958* [n.d.], 72–5.

In preliminary trials with simazin for the control of weeds in maize in E. Africa, promising results were obtained. When used at 1 lb./ac. a wide range of weed spp. was killed, including *Galinsoga parviflora, Datura stramonium, Chenopodium* spp., *Portulaca oleracea, Nicandra physaloides* and *Setaria verticillata,* at stages from germination to a height of 1–2 in. Simazin persisted in the soil for about 12 weeks following application, without causing damage to the maize.—S.M.J.

1119 Grasslands Research Station, Marandellas. **A study of effects of herbicides and cultivation on maize yield.** *Rep. Grassl. Res. Sta., Marandellas 1956-7* [n.d.], 25.

Three cultivations of maize resulted in yield increases of 12·5 bags/ac. over uncultivated plots [1 bag = 200 lb.]. 2, 4-D and MCPA applied as pre-emergence sprays had much less effect on yields than the cultivation treatments.—J.D.J.

1120 Grancini, P. Il diserbo chimico del mais. [**Chemical weeding of maize.**] *Maydica* 1959, **4,** No. 4, 99–113, bibl. 8, illus.

Information is given on the chemical weeding of maize, based on experience in the USA and various European countries. A table gives the results from phytosociological surveys in Italy of weeds present in 2 fields of summer-sown maize (Milan and Bergamo) and 2 fields of spring-sown maize (Milan and Bergamo). Most of the weeds were annuals, the most noxious being *Panicum crus-galli, Amaranthus* spp., *Setaria viridis* and *Digitaria sanguinalis.* Chemical treatment is concerned with annual weeds only and must be carried out before emergence. Good results in controlling weeds in maize were obtained in trials in various localities in northern Italy, in 1958–9, by treatment with atrazin and simazin (atrazin, which has a quicker action, was better than simazin) but some practical difficulties in their use must still be overcome.—E.B.O.

1121 Rogers, W. E. and Nelson, R. R. **Studies on the translocation of minerals and**

carbon compounds between corn and *Striga asiatica* [Abstract]. *Proc. 56th Ann. Meet. N. Carolina Acad. Sci* [contained in] *J. Elisha Mitchell sci. Soc.* 1959, **75**, No. 2, 67.

Examination of *Striga asiatica* plants showed that phloem was well developed in the stems, but efforts to identify this tissue in the haustoria were inconclusive. Xylem tissue appeared to be the important means of connection between host and parasite. Radioisotopes of P and S were translocated rapidly to the parasite when supplied to maize leaves or roots, and accumulated mainly in the leaves of the parasite. ^{14}C applied as radioactive glucose to cut tips of maize leaves accumulated to a greater extent in *S. asiatica* than in maize roots ; similar results were obtained with $^{14}CO_2$. Further studies with ^{14}C indicated that *S. asiatica* was capable of photosynthesis.—R.B.

1122 Young, W. R. and Sifuentes A., J.A. **Biological and control studies on *Estigmene acrea* (Drury), a pest of corn in the Yaqui Valley, Sonora, Mexico.** *J. econ. Ent.* 1959, **52**, No. 6, 1109–11, bibl. 4. [Rockefeller Fdn]

Estigmene acrea has caused severe damage and reduction of stands in autumn-sown maize in N.W. Mexico. Observations indicated that cotton, *Amaranthus palmeri* and *Physalis angulata* are among the hosts for oviposition and larval development, and that larvae migrate into maize fields. In spraying trials, dipterex at 0·5 kg/ha gave satisfactory control. Elimination of the weed hosts is recommended.—R.B.

1123 Pedretti, E. Über Bestimmung und Verteilung autochthoner Spürenelemente in jungen Maispflanzen. [**The determination and distribution of the earliest known trace elements in young maize plants.**] *Ber. schweiz. bot. Ges.* 1958, **68**, 103–44, bibl. 51, illus. [Bot. Anst., Univ. Basel]

The content of Fe, Zn, Mn, Cu, Co, Mo and Ni in the caryopsis of *Zea mays* and the distribution of these trace elements in the seedlings were determined. The qualitative and quantitative methods used are described.—D.B.

1124 Chou, Y.-P. **The accumulation of some minor elements in corn plants grown at different levels of hydrogen-ion concentration.** *Diss. Abstr.* 1959, **20**, No. 2, 440–2, illus., bibl. 1. [Ohio State Univ., Columbus.]

The results are given of studies on the effect of the pH of culture media on the accumulation of 15 elements in maize plants and on the sites at which these elements accumulate in maize leaves in relation to symptoms of toxicity or deficiency.—P.J.B.

1125 Lanza, F. Elementi secondari e microelementi nella nutrizione minerale del mais. [**Secondary elements and micronutrients in the mineral nutrition of maize.**] *Maydica* 1960, **5**, No. 1, 4–23, bibl. 26, illus., English and German summaries. [Sta. Sper. Maiscolt., Bergamo, Italy]

The role of secondary elements (Ca, Mg, S) and micronutrients (B, Cu, Fe, Mn, Mo, Zn, Si, Al, Na) in maize nutrition is reviewed, with regard to physiological stimulation, toxicity and deficiency symptoms. It is concluded that it is not necessary to add these elements to NPK fertilizers and manure in maize cultivation in Italy. [See also *Fld Crop Abstr.* 13 : 626.]—E.B.O.

1126 Bugaĭ, S. M. and Sobčuk, V. V. [**Determination of leaf surface area in maize.**] [Ukrainian] *Ukr. bot. Ž., Kiev (Ukrainian Bot. J.)* 1959, **16**, No. 5, 69–72, bibl. 7, illus.

1127 Ermilov, G. B. and Šaraev, D. Ja. [**Efficiency of the work of the leaves and growth of maize plants.**] [Russian] *Doklady Akad. Nauk SSSR (Proc. Acad. Sci. USSR)* 1960, **130**, No. 3, 682–5, bibl. 2.

During a study of the biology of maize in the Central Urals, information on the Sterling variety was collected from which the relationship between the productive capacity of the leaves, growth conditions and dry-matter accumulation in the vegetative parts of the plants could be established. The laws governing this relationship are embodied in 11 formulae.—M.H.

1128 Mayes, M. **Factors affecting seed set with restricted pollination in corn, *Zea mays* L.** *Diss. Abstr.* 1959, **20**, No. 4, 1120–1. [Rutgers Univ., New Brunswick, New Jersey]

1129 Jones, J. B. **Corn grain yields as related to nutrient element content of leaves and to foliar spray treatment.** *Diss Abstr.* 1959, **20**, No. 2, 448. [Pennsylvania State Univ., University Park]

In trials at 4 locations in Pennsylvania, determinations were made of the N, P, K, Ca, Mg, Mn, B, Cu and Zn contents of the 5th and 6th leaves from the bases of maize plants, sampled when the ears had begun to silk. Increasing rates of N [rates not stated] and plant populations had no significant effect on the nutrient-element content of the leaves. At plant populations of 12,000–16,000/ac. there was no significant correlation between grain yield and the nutrient content of the leaves, whereas at populations of 18,000–20,000 plants/ac., grain yields were significantly and negatively correlated with the K, Mn and B contents of the leaf tissue. Combined grain yields at all 4 locations were significantly and negatively correlated with the K, Mg, Mn, B, Cu and Zn contents of the leaf tissue. In a trial in 1957, the number of harvestable ears and ear weights in 16

single-crosses were significantly increased by foliar spraying with Cu and B. In 1958, foliar sprays containing Cu, Zn, Mo, Fe and B were applied to maize plants when they were 1 ft. high and again later at 3 ft. high. Significant increases in grain yields were obtained only where soil moisture supplies were low during part of the season. The yield response to micronutrient sprays was greatest in drought-susceptible hybrids.—P.J.B.

1130 Fulton, J. M. and Findlay, W. I. **The nutrient composition of hybrid corn as influenced by fertilization. 1. The nitrogen percentage in leaf and grain.** *Canad. J. Soil Sci.* 1960, **40**, No. 1, 42–8, bibl. 8. [Canada Dep. Agric. Res. Sta., Harrow, Ontario]

Hybrid maize, grown for 2 yr. on clay or sandy loam soil, was given 0, 40, 80 or 120 lb./ac. of either N, P_2O_5 or K_2O and 120 lb./ac. of each of the other 2 plant nutrients. N at 40 lb./ac. markedly increased grain yields; the rate of increase diminished where further increments of N were applied. Grain yields increased with increasing P applications on clay soil only. Variations in the amount of P or K applied had little or no effect on the percentage of N in leaf or grain. Where the rate of N alone was varied, (a) the change in percentage N in the topmost leaf was greater than that in the grain, (b) the coefficient of correlation between grain yield and percentage N in the topmost leaf was greater than that between grain yield and percentage N in the grain, and (c) there was a linear relationship between percentage N in the topmost leaf and grain yield. The influence of applied N on percentage leaf N was greater on sandy loam than on clay, although the percentage of N in the topmost leaf on plots not receiving N on both soils was similar.—R.B.

1131 Gorbačeva, A. P. [**Composition of the oil complex in maize grain in relation to zones in USSR.**] [Russian] *Doklady Vsesojuz. Akad. S-H Nauk* (*Proc. Lenin Acad. Agric. Sci.*) 1959, No. 12, 9–12. [All Union Sci Res. Inst. Anim. Husb.]

From a study of the grain in different varieties of maize grown in various regions of the Soviet Union, it was observed that the oil content ranged between 3·1 and 5·5%. It has also been recorded (Kožuhov, 1935) that oil in grain from a world collection of maize varied between 3 and 6·8%. The author's observations confirm that the oil content of the grain in any one variety depends on the region where the crop is grown, e.g. the Kollektivnyĭ var. grown near Moscow contains less crude fat (3·16% of abs. dry matter) than when grown in Georgia SSR (4·05%). The author has studied the composition of the crude fat in relation to free fatty acids, unsaponifiable and neutral oils in the grain of maize varieties grown in different regions in USSR. It is shown, for example, that the variety Voronežskaja 76 in all zones contains a significant percentage of fatty acids (21–32·9% of the crude fat); Bukovinskiĭ 2 contains 38·4–71% free fatty acids and very little pure fat; other varieties (e.g. Krasnodarskaja 1/49 in the Groznensk Province) grown in different zones of the Soviet South contain less fatty acids but as much as 86·6% pure oil. It is concluded that the ratio between free fatty acids and pure (neutral) oil in maize grain depends on the degree of grain ripeness. The synthesizing processes necessary for oil formation depend on suitable enzymatic reactions, for which optimum temperatures are required. In USSR, the unfavourable weather of 1956, especially at the time of wax ripeness in maize, resulted in the grain containing a high percentage of free fatty acids, which, in turn, adversely affected germination capacity. It is therefore claimed that determination of free fatty acids in grain is a good criterion of germination. The relation between free fatty acids and neutral fat is an indication of the degree of grain ripeness and of the capacity of the maize variety for adaptation to the climate where it is to be produced.—M.H.

1132 Santos, I. S. and others. **Use of ammonium sulfate in modifying the maturity of parental corn single crosses.** *Philipp. Agriculturist* 1959, **43**, No. 5, 327–40.

1133 Thomas, W. **Effects of applied nitrogen and sulfur on yield and protein content of corn.** *Agron. J.* 1959, **51**, No. 9, 572–3. [Alabama A. & M. Coll., Normal]

Maize was grown with 120 or 240 lb. N/ac. and 0, 40 or 80 lb. SO_3 (as Na_2SO_4)/ac. Neither N nor S had a significant effect on yield. N at 240 lb./ac. plus S at 40 or 80 lb./ac. significantly increased the percentage of protein in the maize grain.—J.D.J.

1134 Morris, H. D. and others. **The influence of fertilization and variety on corn yields in the Georgia Piedmont.** *Bull. N.S. 55 Georgia Agric. Exp. Stas* 1958, pp. 22, bibl. 7.

Maize, var. Dixie 22, NC–27, Dixie 18, Minhybrid 408 and Hastings Prolific, were grown with 0, 250, 500 or 1000 lb. 10–10–10 (NPK) fertilizer/ac. during 1953–5. Dixie 22 gave the highest and Hastings Prolific the lowest yields, at all fertilizer levels. Adapted hybrids (Dixie 22, NC-27) outyielded Hastings Prolific to a greater extent at high rates of fertilization or during dry weather than at low rates of fertilization or during favourable growing conditions. Yields of adapted hybrids increased with all increases in fertilizer rates during all 3 years, while those of Hastings Prolific did so during 1955 only. Dixie 22 yielded 60·7 bu. grain/ac. where given 1000 lb. fertilizer/ac.

The percentage of lodging was 15–20 for adapted hybrids and 51 for Hastings Prolific. NPK had little effect on percentage lodging and increased the size of ears and the number of ears per stem. The percentage of protein in Dixie 22 and NC-27 grain was lower than in other varieties, but yields of grain protein/ac. were higher. Manuring was more profitable where adapted hybrids, rather than other varieties, were grown.—R.B.

1135 Tanganyika Agricultural Corporation. **Rufiji Basin Survey Scheme. Trial farms.** [Maize] *Rep. Tanganyika agric. Corp.* 1957–8, 92–3. [Received Jan. 1960]

In a fertilizer experiment at Rujewa, maize received 112 lb. triple superphosphate/ac., with or without 112 lb. ammonium sulphate/ac. Yields were 3440 lb./ac. on plots which received P only, 3800 lb./ac. on those which received P + N, and 2910 lb./ac. on untreated controls. In a date-of-sowing trial, yield decreased from 6760 lb./ac. on plots sown in Dec. to 1080 lb./ac. on plots sown in late March.—A.M.H.

1136 Strang, J. and Broue, P. **The effect of nitrogen on non-irrigated maize sown in pasture slits.** *J. Aust. Inst. agric. Sci.* 1959, **25**, No. 4, 312–4, bibl. 5.

Field experiments were carried out at Brundee in the Shoalhaven flood plain, New South Wales, to determine the effect of N on GH 128 hybrid maize sown at 10 lb./ac. in 6 in. slits cut in a perennial ryegrass/red clover/white clover pasture. $(NH_4)_2SO_4$ was applied to the maize, at 0, 1, 2 or 5 cwt./ac. at sowing, when 12 and 30 in. tall and at tasseling. Applications of 2 cwt. $(NH_4)_2SO_4$/ac. at tasseling resulted in a higher grain N percentage (1·44) and grain yield (85·9 bu./ac.) than other treatments. By using a ryegrass-dominant pasture (summer-dormant), competition for water between pasture and the maize crop was reduced. Maize slit-sown into *Pennisetum clandestinum* and *Paspalum dilatatum* (non-dormant summer pasture) failed to grow because of competition for water. It was suggested that slit-sowing would be useful, particularly in suitable irrigation areas, where economic maize-grain production is required without reducing the proportion of available winter pasture.—S.M.J.

1137 Davies, J. C. **Storage of maize in a prefabricated aluminium silo in tropical conditions.** *E. Afr. agric. J.* 1960, **25**, No. 4, 225–8, bibl. 5. [Ent. Sect., Dep. Agric. Uganda]

After 154 days' storage in a silo, 34% of maize grains in the surface layer of grain were attacked by *Calandra oryzae*. Fumigation of this grain with a mixture of 3 parts ethylene dichloride and 1 part of carbon tetrachloride, applied at 6 pints/ton of grain, gave complete control of *C. oryzae*.—S.M.J.

1138 Elitropi, C. La conservazione del mais dopo il raccolto. [**Maize storage after harvesting.**] *Maydica* 1959, **4**, No. 4, 114–25, bibl. 11, illus.

The factors involved in the storage of maize grain are discussed and the methods used for its storage in Italy, particularly in raised silos, are described.—E.B.O.

SWEET-CORN

1139 Vittum, M. T. **Sweet corn responds to irrigation.** *Fm Res.* 1959, **25**, No. 2, 15. [New York State Agric. Exp. Sta., Geneva]

Sweet-corn was grown for 5 yr. on silt loam soil capable of retaining 3·4 in. available water in the top 2 ft., and irrigated each time 1·7 in. of available water had been lost. Precipitation supplied 8·4 in. water and irrigation 3·4 in. water. Under irrigation, 119 marketable ears were produced per 100 plants, compared with 109 ears for plants grown without irrigation. Irrigation increased the average weight per ear from 10·7 to 12·2 oz. and the yield of ears plus husks from 4·9 to 6 tons/ac.—R.B.

1140 Harris, E. D., Jr. **Identification, biology and control of subterranean insect pests of the Everglades area.** *Ann. Rep. Fla Agric. Exp. Stas* 1958, 283.

Seed of Golden Security sweet-corn was wetted with 4% methyl-cellulose solution, coated with dieldrin or heptachlor at the rate of 1 part a.i. per 12·5 parts of seed to control corn wireworm (*Melanotus communis*), and sown in Dec. 1957. Plots examined after 1 month contained 14, 25 and 65% wireworm-damaged plants where heptachlor, dieldrin and no seed treatment, respectively, were used. Dieldrin-treated plots contained 72%, heptachlor-treated plots 69% and untreated plots 3% of dead wireworms. Differences in sweet-corn stands were not significant. Similarly treated seed was sown in Feb. 1958, but because of adverse weather no germination occurred for 2 weeks. Under these conditions, percentage germination was 3·5, 13·3 and 60·3 for dieldrin-treated, heptachlor-treated and untreated seed, respectively.—R.B.

SORGHUMS AND OTHER MILLETS

See also Abs. 1086.

1141† Kurtkoti, F. B. and Divekar, C. B. **"Improved method" of jowar culti-**

vation. *Mysore agric. J.* 1959, **34**, No. 1, 5–14, bibl. 6, illus. [Agric. Res. Sta., Dharwar, India]

The 2 main differences between the improved and the existing methods of cultivating *Sorghum vulgare* are : (1) the application of superphosphate at 20 lb. P_2O_5 per acre before sowing and ammonium sulphate at 20 lb. N per acre at sowing time and again 3 weeks later ; (2) a spacing of 24 in. (instead of 15 in.) between rows. Common to each method were basic manuring with FYM and drilling the seed at 4 lb. per acre. Over 3 years the improved method produced on average a 31% increase of grain and 22% of fodder. There was a net profit of Rs 56·81 per acre.—D.B.

1142† Australasian Irrigator. **Commercial sorghum varieties still the best.** *Australas. Irrig.* 1959, **4**, No. 12, 24.

Following 2 crops of oats and sudan grass [*Sorghum sudanense*] after a ryegrass/subterranean clover ley, the sweet sorghum varieties Early Orange and Saccline yielded 21·6 and 20·2 tons green forage/ac., respectively, at Finley, N.S.W. 144 lb. superphosphate/ac. was applied at sowing (10 lb. sorghum seed/ac.) and the crop received 4 irrigations.—S.M.J.

1143 Sharma, B. S. **Isolation of a perennial sorghum.** *Curr. Sci.* 1959, **28**, No. 10, 408. [Micro Techn. Res. Labs (Private), Dehra Dun, India]

During the selection and segregation of *Sorghum vulgare* to obtain a rust-free variety certain rust-free individuals were observed to be perennial in habit. At Dehra Dun these plants are not only perennial, they also flower and produce seed perpetually, provided that the winter temperature does not fall below 10°C and the summer temperature does not rise above 40°C. Once sown, this variety lasts as long as moisture and nutrients are available. During unfavourable weather it remains dormant but revives on the return of favourable conditions. In field trials yields at the rate of 16,000 to 20,000 lb. grain per acre were obtained.—D.B.

1144† Orbea, J. R. Introducción a la Argentina, descripción y cultivo de *Sorghum roxburghii* var. *hians* Stapf. [**Introduction into Argentina, description and cultivation of *S. roxburghii* var. *hians*.**] *Rev. Fac. Agron., La Plata* 1959, **35**, No. 1, 79–97, bibl. 15, illus., English summary.

A description is given of *Sorghum roxburghii* var. *hians*, introduced a few years ago into Argentina from the USA. In experimental plots in La Plata and at the Estación Experimental de Pereyra, this plant behaved as a perennial and had no rhizomes. Data on yields of grain and forage, chemical composition, nutritive value and behaviour under cultivation were obtained. *S. roxburghii* var. *hians* has a long vegetative period, but is less palatable and has a higher content of dhurrin than *S. sudanense*.—E.B.O.

1145 Rojas, G. M. and Rubio, C. J. Efectos del ácido 2,4-diclorofenoxiacético sobre la población de malezas en sorgo (*Sorghum vulgare* var. *roxburghii*. [**Effect of 2,4-D on the weed population in sorghum (*S. vulgare* var. *roxburghii*).**] *Ciencia, Méx.* 1959, **19**, No. 4–5, 74–6, bibl. 4, English summary. [Inst. Tecn., Monterrey, Mexico]

In the plot trial described, treatment with 2,4-D, 49·5% a.e., was applied to spring-sown sorghum var. Shallu dwarf. Johnson grass (*Sorghum halepense*) was the only noxious grass weed present ; other important weeds were *Croton dioicus*, *Parthenium hysterophorus*, *Solanum rostratum*, *Tagetes* sp. and *Raphanus* sp. The yields of sorghum (kg/54 m^2 plot) from the 5 treatments tested were : tractor-cultivated 3 times, 5·23 ; hoed 3 times, 5·05 ; treated with 2,4-D once (1 kg a.e./ha before emergence), 4·67 ; treated with 2,4-D once (0·75 kg a.e./ha, after emergence), 3·54 ; untreated control, 3·16. The effect of 2,4-D on the competition between crop and weeds is discussed. Treatment with 2,4-D resulted in increased growth of Johnson grass because of lack of competition from other weeds.—E.B.O.

1146 Pfeiffer, R. K. and Burleigh, R. J. F. **Experimental results of selective weed control in sorghum (dura) with MCPA and 2,4-D in the Sudan.** *Proc. Afr. Weed Contr. Conf. S. Rhodesia, July 1958* [n.d.] 86–91.

The application of MCPA or 2,4-D at 0·5 or 1 lb. a.e./ac. to sorghum resulted in yield increases of 40–100%. The 1 lb. rates produced a 95% weed kill (21 weed sp. controlled are listed) but MCPA was preferable to 2,4-D for controlling *Cyperus rotundus*. In experiments in which 2,4-D and MCPA were compared with untreated, hoed control plots and untreated, unhoed plots, the application of 0·5 lb. MCPA/ac. resulted in a yield of 1100 rotls/feddan [1 rotl = 0.99 lb., 1 feddan = 1·038 ac.] compared with 622 from late-hoed controls and 595·6 rotls/feddan from unhoed controls. —S.M.J.

1147 Gaudefroy-Demombynes, P. Activités du Centre de Recherches Agronomiques de Bambey dans la région du fleuve Sénégal (hors zone deltaïque). 1955–1956. [**Work of the Centre de Recherches Agronomiques, Bambey, in the region of the River Senegal (outside the delta area). 1955-6.**] *Bull. agron. Fr. d'out. mer* 1959, No. 16, 127–58, illus.

This account of trials carried out on African farms deals mainly with sorghums (mostly *Sorghum cernuum*, also *S. margaritiferum*). The principal aspects considered were : mechanical weeding of sorghum;

treatment with fungicides and insecticides ; manuring ; possibility of growing other crops besides sorghum. Groundnuts are grown in the region of Matam and Bakel.—E.B.O.

1148† Mehta, B. V. and Shah, C. C. **Accumulation and movement of minerals in 'Bajri' (*Pennisetum typhoideum*).** *Indian J. agric. Sci.* 1958, **28,** No. 4, 583-95, bibl. 15. [Inst. Agric., Anand, Bombay]

The accumulation of N, P, K, Ca and Mg, production of dry matter, and the total cation content in the leaf, stem, root and grain of *P. typhoideum* were determined at 5 growth stages and tabulated. Between dough stage and maturity, these elements were transferred to the grain from other parts of the plant. Some K and Ca also passed out of the plant into the soil, but the plant was continually enriched with N and to some extent with P.—D.B.

1149 Bono, M. Quelques observations sur le faux-épi de certains mils *Pennisetum* cultivés. **[Some observations on the false-ear of certain cultivated millets (*Pennisetum* spp.).]** *Bull. agron. Fr. d'out. mer* 1959, No. 16, 107–13, bibl. 4, illus. [Centre Rech. Agron., Bambey, Senegal]

1150 Grasslands Research Station, Marandellas. **A study of effects of fertilizers and planting-density on the yield of rapoko [*Eleusine coracana*].** *Rep. Grassl. Res. Sta. Marandellas 1956-7* [n.d.], 21–2.

Grain yields of *Eleusine coracana* increased by nearly 30% when ammonium sulphate was applied at 300 lb./ac., but there was no further response to heavier dressings. The seed rate (8 and 16 lb./ac.) and applications of P had no effect.—J.D.J.

1151 Kornilov, A. A. **[Panicle formation and fructification in *Setaria italica* under continuous light.]** [Russian] *Doklady Akad. Nauk SSSR* (*Proc. Acad. Sci. USSR*) 1960, **130,** No. 1, 234–6, bibl. 9, illus. [Stavropol Agric. Inst.]

This species is a typical short-day plant, its development being greatly accelerated in short day. However, the varieties which originate in northern or mountainous areas develop normally in long day. This 3-yr. study (glasshouse tests) was carried out at the Karagandin Experiment Station (1955–6) and at the Stavropol Agricultural Institute (1958). It shows that the late-ripening southern lowland varieties of *S. italica* from China, India and South Africa form flowers and produce seed under continuous light of adequate intensity. [See also *Fld Crop Abstr.* 2 : 1354.]—M.H.

RICE

1152 Trivulzio, G. Risicoltura in Francia. **[Rice-growing in France.]** *Riso* 1960, **9,** No. 1, 10–13, illus.

1153 Levett, J. **Rice in Hungary.** *World Crops* 1960, **12,** No. 2, 58–9.

Fish (mainly carp) are bred in the flooded rice fields, thereby offsetting the cost of rice production and reducing the number of weeds, the seeds of which are eaten in large quantities by the fish. The 7-yr. rotation system is 3 yr. rice, 2 yr. grass or clover, 1 yr. cereal and 1 yr. roots. The varieties Dunghan Shali and Arpa Shali are widely grown. Uzros 17, Dobrovsky 129 and Precoce Alorio are recent introductions.—S.M.J.

1154 Balsaver, D. M. **Growing rice in India.** *Span* 1959, **2,** No. 3, 122–5, illus.

The conditions for growing, and the cultivation of, rice in India are described.—S.M.J.

1155 Penny, J. M. Melhor período de plantação. **[The best date for sowing rice.]** *Lavour. arroz.* 1960, **14,** No. 158, 13–14. [Esta. Exp. Arroz, Gravataí, Rio Grande do Sul, Brazil]

A table shows the average yields of several rice varieties, including both early and late types, which were sown at 7 dates from 15 Sept. to 15 Dec. for several years. The early varieties yielded best (3800 kg/ha) when sown during 15–30 Oct., and the late varieties yielded best (3900–4000 kg/ha) when sown during 15 Sept.–30 Oct.—E.B.O.

1156 Thambiayah, S. **Mechanical row seeding of swamp rice.** *Trop. Agriculturist* 1958, **114,** No. 4, 255–7, illus. [Dep. Agric., Ceylon] [Received Feb., 1960]

1157 Naidu, G. V. B. **Line planting of paddy made easy.** *Indian Fmg* 1960, **9,** No. 12, 26–7. [Reg. Arecanut Res. Sta., Kyathasandra]

Line planting, one of the most important features of the Japanese method of rice cultivation, is facilitated by the use of a square frame 30 × 30 in. divided into 9 equal quadrats. The frame is laid on the ground and rice seedlings are transplanted at the corners of each quadrat.—D.B.

1158 Vose, P. B. **Irrigated rice in California.** *World Crops* 1960, **12,** No. 4, 127–9, bibl. 4, illus.

Rice production in California is described.—S.M.J.

1159 Ghosh, B. N. and Bhattacharjee, B. K. **A preliminary report on the time of submergence under 8″-depth of water on growth and yield of winter (aman) paddy.** *Sci. and Cult.* 1959, **25,** No. 2, 154–6, bibl. 3. [Rice Res. Sta., Chinsurah, Hooghly, India]

For maximum tiller production, plant height and yields of grain and straw, the best conditions were submergence in 8 in. of water for about 4

weeks immediately after transplanting, followed by draining the land and keeping it in a puddled condition until harvest.—D.B.

1160 KASAI, T. and others. **On the dispersed irrigation method with wheat straw bundles in a paddy field.** [Japanese] *Proc. Crop Sci. Soc. Japan* 1959, **28**, No. 1, 51–2, bibl. 8, English summary. [Yamanashi Agric. Exp. Sta.]

Rice plants suffer from the low temperature of the water where irrigation channels enter a rice field. A row of wheat-straw bundles (each about 10 cm in diameter) placed at the entrance to the channel, dispersed the irrigation water, retarded the rate of flow, raised the temperature of the water and resulted in better growth and higher yields. F. Eng. s.—D.B.

1161 CHANG, J. C. C. **A conclusive study on flooded paddy sugarcane in Taiwan.** [Chinese] *J. agric. Assoc. China* 1959, No. 27, 63–73, bibl. 24, English summary. [Taichung Sugar Factories Centre, Taiwan Sugar Corporation]

Methods of interplanting sugar-cane and rice for maximum yields of each crop on the small farms (average 1·25 ha) of Formosa are studied. F. Eng. s. —D.B.

1162 CHANG, H. and others. **A study on the interplanting of sugar-beet with autumn paddy rice and autumn paddy sugar-cane.** [Chinese] *Rep. Taiwan Sugar Exp. Sta.*, 1959, No. 19, 1–19, bibl. 6, illus., English summary.

Cultivation details are given for : (1) intercropping rice and sugar-beet, and (2) cropping rice with sugar-cane and sugar-cane with sugar-beet. In the first system rice is planted end of July and harvested before the end of Oct. Early in Oct. water is drained from the field and the land prepared for sowing sugar-beet, which is harvested in mid-Feb. The experiment was carried out during 3 years and the average yields (in metric tons) for the 7 months of land use were : 3·6 of hulled rice and 30 of sugar-beet roots with 14·5% available sugar, giving 4·5 of sugar + 30 of tops for fodder. This system of cropping was twice as profitable as 1 crop of autumn rice and 1 of winter wheat. In the second system, sugar-cane is planted in fields of autumn rice before the rice reaches the flowering stage. After the rice harvest, sugar-beet is planted between the rows of sugar-cane. Yields were good and diseases and pests were few. F. Eng. s.—D.B.

1163 JORDAN, Hashemite Kingdom of. **Rice trials.** *7th Annu. Rep. Deir Alla Res. Sta.* 1958, pp. 24–9.

In a test of 26 rice varieties obtained from Australia, Iraq and Italy, the following proved to be best : Malabar, Ajami Montakhab and Kanan No. 2. A test on the effect of watering rice at 5 different growth stages shows that yields of the crop are directly related to water supply at all growth stages. Daily irrigation is advised throughout growth. [See also *Fld Crop Abstr* : 11 : 863.] —M.H.

1164 TANGANYIKA AGRICULTURAL CORPORATION. **Rufiji Basin Survey Scheme. Trial farms.** [**Rice**]. *Rep. Tanganyika agric. Corp.* 1957–8, 84 and 87–8. [Received Jan., 1960]

At Beta, the highest yields were from the varieties Kahogo and Bengal sown in Jan. Sowing in Feb. generally gave lower yields. In one trial at Lumemo there was little difference in yield between Dec., Jan. and Feb. sowings. The results of a combined date-of-sowing and spacing trial are given. [No conclusions given.] In a variety trial, Demerara Creole, Bangkok 1376 and Kahogo India gave the highest yields.—A.M.H.

1165 DEPARTMENT OF AGRICULTURE, BRITISH GUIANA. [**Rice trials.**] *Rep. Dir. Agric., Brit. Guiana 1958* [n.d.] 15–19.

The rice varieties C.A.S. 451, 542, 719 and 867 have invariably outyielded the standard variety C.A.S. 79 at the Central Agricultural Station, but have failed to do so at the Mahaicony/Abary Rice Development Scheme. Mixed NP fertilizers (not N or P singly) have increased paddy yields by 500–1000 lb./ac., i.e. by 25–40% over those of untreated controls. At one location $MnSO_4$ at 50 lb./ac. increased grain yields by 300 lb./ac.—J.D.J.

1166 CRANE, L. E. **New rice variety " Gulfrose ", resistant to hoja blanca disease, is introduced.** *Rice J.* 1959, **62**, No. 13, 2–3 and 17, illus. [Rice-Pasture Exp. Sta., Beaumont, Texas]

1167 VAN DOESBURG, P. H. De Hoja Blanca ziekte van de rijst. [**Hoja blanca disease of rice.**] *Jaarversl. LandbProefst. Suriname 1958* 1959, 70–1.

Symptoms similar to those of hoja blanca appeared in rice plants in Surinam in July 1958. Experiments in Venezuela have shown that the variety Holland 5023 is almost completely resistant to the disease.—R.B.

1168 VASCONCELLOS, J. C. Sementes estranhas do arroz. [**Weed seeds in rice.**] 1958, pp. 29, bibl. 14, illus., English summary, Lisboa : Minist. Econ., Com. reg. Comércio Arroz. [Received Jan., 1960]

The seeds of the most common weeds present in paddy in Portugal are described and illustrated. Tables show their distribution in the principal rice areas of Portugal.—E.B.O.

1169 Vasconcellos, J. C. Evolução da vegetação infestante dos arrozais no concelho de Alcácer do Sal. [**Development of weeds in the rice-fields in the municipality of Alcácer do Sal (Portugal).**] 1959, pp. 36, bibl. 17, English summary, Lisboa : Minist. Econ., Com. reg. Comércio Arroz.

The results are given from botanical surveys carried out from April to September in rice nurseries and rice fields in Alcácer do Sal to study the development of weeds and algae during the growth period of rice. [See also *Fld Crop Abstr.* 13 : 666.]—E.B.O.

1170 Smith, R. J. **The differential varietal response of rice to 2,4-D as influenced by the stage of growth and the rate of application.** *Rice J.* 1958, **61**, No. 10, 18–19 and 26–7, bibl. 5. [Arkansas Agric. Exp. Sta.]

1171 Parker, C. and Byers, D. S. **The use of pentachlorophenol for grass control in rice.** *Proc. Afr. Weed Contr. Conf. S. Rhodesia, July 1958.* [n.d.] 92–8, bibl. 11.

Pre-emergence or early post-weed-emergence sprays of 2,4-D or early post-weed-emergence sprays of TCA, dalapon, PCP, dinoseb or aminotriazole may be used following flooding of rice fields to give partial control of weed grasses, such as *Echinochloa* spp. and *Panicum* spp., but either a period of time must elapse for micro-biological breakdown to occur, or leaching by further flooding must take place before the rice can be safely sown. PCP applied at 2–3 lb. a.e./ac. or dinoseb (amine) at 1·5 lb. a.e./ac. + wetter were selective and killed *Echinochloa holubii* when applied to rice at the spike stage.—S.M.J.

1172 Kawatei, K. and Kato, Y. **Studies on establishment of a weeding system in field cultivation. 2. Influence of weeds on the growth and the yield of upland rice plant.** [Japanese] *Proc. Crop Sci. Soc. Japan* 1959, **28**, No. 1, 68–72, bibl. 14. English summary. [Tokyo Univ. Farm]

Upland rice is very sensitive to the rapidly growing weeds *Chenopodium album*, *Polygonum orientale* and *Amarantus blitum*, particularly during the first few weeks following germination and after flower-bud differentiation. Weeding at each of these 2 periods is sufficient. F. Eng. s.—D.B.

1173 West African Rice Research Station. **Dormancy and viability of seed.** *Rep. W. Afr. Rice Res. Sta., Rokupr, Sierra Leone, 1958*, 1959, 20.

From the results of previous experiments on seed viability an equation was formulated which enabled the half-viability period (period from harvest until germination has dropped to 50%) to be calculated, where the moisture content of the grain and the storage temperature were given.—S.M.J.

1174 Nagato, K. and Ebata, M. **Studies on white-core rice kernel. 2. On the physical properties of the kernel.** [Japanese] *Proc. Crop Sci. Soc. Japan* 1959, **28**, No. 1, 46–50, bibl. 7, illus., English summary. [Nagoya Univ.]

1175 Shimabuku, K. **Observations on the apical meristem of rice roots.** *Bot. Mag. Tokyo* 1960, **73**, No. 859, 22–8, bibl. 13, illus., Japanese summary. [Univ. Tokyo, Japan]

An anatomical study was made of the root-tip meristems of seminal and adventitious roots of *Oryza sativa*. As a rule, the root tip of *O. sativa* has 3 growth zones : stele, cortex/epidermis, and root-cap, as in *Zea mays*. There were also some plants with 4 growth zones, with separate initial cells for epidermis and cortex as in *Triticum*. It is thought that this is the first time that 2 growth patterns have been observed within the same species.—D.B.

1176 Kido, M. and Yanatori, S. **Studies on starch accumulating capacity of root of rice plant.** [Japanese] *Proc. Crop Sci. Soc. Japan* 1959, **28**, No. 1, 10–11, bibl. 7, illus., English summary. [Niigata Univ.]

The physiological reasons are given for the presence of starch in the roots of rice seedlings sown in autumn in lowland seed beds. (Hitherto starch has been found only in the roots of rice seedlings in upland seed beds.) Starch accumulates in the root tissues in this order : cortical parenchyma near central cylinder, epidermis, root tip. The starch grains of the root resemble those of the panicle ; they are approximately cubical in shape and about half the size of those in the leaf sheath and culm. F. Eng s.—D.B.

1177 Fujii, Y. **On the development of branch-roots on successive nodes of rice plants.** [Japanese] *Proc. Crop Sci. Soc. Japan* 1959, **28**, No. 1, 15–16, bibl. 6, illus., English summary. [Saga Univ.]

The relationship between branch-root development and leaf emergence was studied, and root development in lowland and upland rice was compared. Under lowland conditions, rice roots were less branched and shorter lived than under upland conditions. F. Eng. s.—D.B.

1178 Yamagata, M. **Observations on the roots of rice plants in early- or late-season culture by means of transparent plastic pots.** [Japanese] *Bull. Fac. Agric. Yamaguti* 1959, No. 10, 1245–54, bibl. 4, illus., English summary.

1179 YAMAGATA, M. **New device of the transparent plastic pot for rice culture.** [Japanese] *Bull. Fac. Agric. Yamaguti* 1959, No. 10, 1255–62, bibl. 2, illus., English summary.

An illustrated account is given of the construction and use of new and larger plastic pots for the study of rice roots and soil. F. Eng .s.—D.B.

1180 KAUFMAN, P. B. **Development of the shoot of *Oryza sativa* L. 1. The shoot apex.** *Phytomorphology* 1959, **9**, No. 3, 228–42, bibl. 69, illus. [Univ. Michigan, Ann Arbor, USA]

A study was made of the changes in form and size of the shoot apex of *O. sativa* during ontogeny and of the cytohistology of vegetative and reproductive shoot apices.—D.B.

1181 KAUFMAN, P. B. **Development of the shoot of *Oryza sativa* L. 2. Leaf histogenesis.** *Phytomorphology* 1959, **9**, No. 3, 277–311, bibl. 73, illus. [Univ. Michigan, Ann Arbor, USA]

After a review of the literature on the gross morphology and histological development of the leaves of grasses, an illustrated account is given of the form and structure of the rice leaf, the initiation and development of the leaf primordium, the formation of ligule and auricles and the initiation and development of lamina and sheath.—D.B.

1182 INOSAKA, M. **On the growth of leaves and tillers in rice plant in relation to the vascular connection.** [Japanese] *Bull. Fac. Agric. Miyazaki* 1959, **34**, No. 12, 67–76, bibl. 4, English summary.

1183 SEN, P. K. and BOSE, T. C. **Effect of growth-regulating substances on rice.** *Indian Agric.* 1959, **3**, No. 1, 13–16, bibl. 10. [Dep. Agric., Calcutta Univ.]

IAA and MH were applied to rice (a day-neutral, early variety and a short-day, late variety) in 4 concentrations (from 0·0001 to 100 ppm.) and at 3 stages (seeds soaked, and plants sprayed at 5th leaf stage and before flowering). IAA up to 1 ppm. increased plant height. After the seed-soaking treatment flowering was delayed in the day-neutral variety and hastened in the short-day variety. When plants were sprayed, flowering in both types was delayed.—D.B.

1184 MISRA, G. and SAHU, G. **Physiology of growth and reproduction in rice. 2. Effect of plant growth substances on three winter varieties.** *Pl. Physiol.* 1959, **34**, No. 4, 441–5, bibl. 27. [Ravenshaw Coll., Cuttack, India]

The effect of 3 plant growth-substances, IAA, NAA and TIBA at 500, 250 and 100 ppm. upon the growth and reproduction of 3 winter varieties of rice has been studied. The treatments consisted of a preliminary seed soaking for 72 hours followed by a weekly foliar spray, beginning at the 4th week and continuing until ear emergence. The study has led to the following conclusions : (1) IAA had no effect on flowering in the early-winter and mid-winter varieties, but brought about a significant earliness in flowering in the late-winter variety. It somewhat delayed vegetative growth in the initial stages in all the varieties, but the longer-duration varieties largely recovered. It had no effect on grain yield or the components of yield. (2) NAA brought about a significant delay in ear emergence in the early-winter variety, had no effect in the mid-winter variety, and produced significant earliness in flowering in the late-winter variety. It delayed vegetative growth at first, but subsequently the height of the treated plants increased over that of the controls in the mid- and late-winter varieties. The number of spikelets and grains per panicle and the grain plumpness were favourably influenced, but there was no increase in total grain yield because the number of panicles formed per plant decreased. (3) TIBA was without any effect in the early- and mid-winter varieties but brought about a significant earliness in the late-winter variety. It increased the production of tillers and leaves in the mid- and late-winter varieties at mature stages. It had no effect on grain yield in the early-winter variety, but induced a higher yield at lower concentrations in mid- and late-winter varieties by increasing the number of grains formed per panicle and the percentage of seed setting. F. s. [See also *Fld Crop Abstr.* 12 : 682 and 1242.]—D.B.

1185 TENSHO, K. and others. **The uptake of strontium 90 and calcium by lowland and upland rice from soil, and their distribution in the plants.** *Soil Pl. Fd* 1959, **5**, No. 1, 1–9, bibl. 23, illus. [Univ. Tokyo, Japan]

From pot experiments, in which various parts of plants of lowland and upland rice were analysed, it was indirectly verified that high ^{90}Sr content of the grain is attributable to direct contamination from radioactive fall-out rather than to root absorption. The greater development of a surface root system in lowland than in upland rice may account for the higher contamination through the roots in lowland rice. F. s.—D.B.

1186 OKAMOTO, Y. **Physiological studies on the effects of silicic acid upon rice plants.** [Japanese] *Proc. Crop Sci. Soc. Japan* 1959, **28**, No. 1, 35–40, bibl. 5, English summary. [Wakayama Univ.]

The results showed that SiO_2 was involved in the production and translocation of carbohydrates and proteins, promoted plant growth when the level of underground water was high, and was essential for normal ripening. F. Eng. s.—D.B.

1187 Shirakura, N. and others. **The change in the metabolic activity of the rice plant affected by cold water as viewed from its nitrogen and carbohydrate contents.** [Japanese] *Proc. Crop Sci. Soc. Japan* 1959, **28**, No. 1, 25–7, bibl. 6, English summary. [Shinshu Univ.]

1188 van Amson, F. W. and Ehrencron, V. K. R. Onderzoek naar de zouttolerantie van rijst. [**Investigation on salt tolerance in rice.**] *Jaarversl. LandbProefst. Suriname 1958* 1959, 11–13.

Mixtures of saline clay soils, containing (a) 13, (b) 161, (c) 574, (d) 669, (e) 1291, (f) 1471 mg Cl/100 kg dry soil were used in pot experiments with rice. Seed germinated and developed normally in soils (a) and (b), but germinated poorly and soon died in the other soils. Rice seedlings 6 weeks old planted in soil (c) survived for 2 weeks only, while those planted in soils (a) and (b) developed normally. These plants were grown to maturity and received rainwater sufficient to replace losses by evaporation.—R.B.

1189 Ota, K. and Yasue, T. **Studies on the salt injury to crops. 14. Relation between the temperature and salt injury in paddy rice.** [Japanese] *Proc. Crop Sci. Soc. Japan* 1959, **28**. No. 1, 33–4, bibl. 3, illus., English summary. [Gifu Univ.]

Salt injury was more severe in plants grown at a higher air-temperature of 30·7°C (in a glasshouse with relative humidity of 63·5%) than at a normal temperature of 27·2°C (at 10.0 a.m. in the open air with rel. humidity of 73·4%). Conditions in the glasshouse promoted transpiration and hence intake of salt solution. F. Eng. s.—D.B.

1190 Misra, G. **Influence of day length on sterility in rice.** *Curr. Sci.* 1960, **29**, No. 3, 105–6, bibl. 8. [Ravenshaw Coll., Cuttack-3, India]

1191 West African Rice Research Station. **Factors affecting the duration of rice varieties.** *Rep. W. Afr. Rice Res. Sta., Rokupr, Sierra Leone, 1958* 1959, 18–19.

Four sowings each were made of 1 photoinsensitive rice Tai Chu 65 and 3 late photosensitive rices Lead, Radin China 4 and Wag Wag at 5 locations at different latitudes. For the photosensitive rices at all stations there was a reduction in maturation period (measured as the number of days from sowing to modal flowering + 30 days) as sowing was progressively delayed, but no marked effect of latitude on duration for any given sowing date was apparent.—S.M.J.

1192 Department of Agriculture, Federation of Malaya. [**Rice.**] *Rep. Dep. Agric. Malaya 1958*, 1959, 32 and 61.

1. Photoperiodic effect on flowering. Siam 29, a local indica variety, was sown at monthly intervals at the Pulau Gadong Padi Experiment Station, Malacca (2°12′ N. lat.) and at Kota Bahru, Kelantan (6°09′ N. lat.). The small difference between daylengths at these 2 localities was sufficient to affect the period from sowing to ear emergence. There was evidence that this period was shorter at the higher latitude because of the cumulative effect of longer nights during the critical phase of flower initiation.

2. Plant spacing. Close spacing of the order of 6 × 6 in. or 9 × 9 in. gave high yields of grain but a low number of tillers. Spacing at 15 × 15 or 18 × 18 in. gave a greater number of tillers but lower yields.—E.B.O.

1193 Yanagisawa, M. and Takahashi, J. **Study on the sampling of rice plants. 1. On the variation of inorganic composition of rice plant at harvest.** *Soil and Pl. Fd* 1959, **4**, No. 4, 173–80, bibl. 6. [Nat. Inst. Agric. Sci., Tokyo, Japan]

1194 Mitsui, S. and others. **Asparagine test in relation with the nitrogen nutritional status of crop plants. 1. Rice.** *Soil and Pl. Fd* 1959, **4**, No. 4, 189–95, bibl. 13. [Fac. Agric., Univ. Tokyo, Japan]

The asparagine test may be used for determining fertilizer top-dressing requirements. F. s.—D.B.

1195 Abichandani, C. T. and Patnaik, S. **Influence of fertilizer placement on nitrogen content and yield of rice in waterlogged soils.** *J. Indian Soc. Soil Sci.* 1959, **7**, No. 3, 171–5, bibl. 6. [Central Rice Res. Inst., Cuttack, Orissa]

The effect of surface and sub-surface placement of N fertilizer (using $(NH_4)_2SO_4$ at 20 lb. N/acre) was studied in 9 trials over 5 years. The surface application consisted of broadcasting $(NH_4)_2SO_4$ on standing water 3–4 weeks after transplanting. Bunds surrounding the plots restricted the flow of water for at least 48 hr. after fertilizer application. For deep placement, 2 methods were used : (1) fertilizer was broadcast on the soil surface just before puddling, for which the minimum quantity of water was used ; (2) 3–4 weeks after transplanting, 1-in. diameter balls, consisting of fertilizer, soil and water, were inserted 2 in. below the surface of waterlogged soil, at the rate of 1 ball for 4–6 hills. Judging by N content of plants and increased grain yields, the fertilizer efficiency of sub-surface placement was higher than that of surface application for both the main season rainfed crop and the second season irrigated crop. —D.B.

1196 Schroeder, H. W. and Rosberg, D. W. **Drying rough rice with infra-red radiation.** *Rice J.* 1959, **62**, No. 6, 16 and 36–8. [Coll. Sta., Texas]

The results from preliminary trials in drying paddy with infra-red radiation indicated possibilities for developing a faster method than the conventional drying systems now in use. [See also *Fld Crop Abstr.* 11 : 1048.] F. s.—E.B.O.

1197 Lin, T. **The influence of insecticides on the seed germination percentage of rice, wheat and soybean during storage.** [Chinese] *J. agric. Assoc. China* 1959, No. 27, 60–2, bibl. 2, English summary. [Taiwan Agric. Res. Inst.]

Pyrenone or lindane mixed with rice, wheat and soyabean during 8–12 months storage had no adverse effect on germination whether these insecticides were present in high or low concentrations. According to results of experiments, the concentration of lindane could be increased (for greater protection) from the present 4 ppm. to 6·7 ppm. without reducing seed viability. F. Eng. s. —D.B.

1198 Prevett, P. F. **A study of rice storage under tropical conditions.** *J. agric. Engng Res.* 1959, **4**, No. 3, 243–54, bibl. 8. [Pest Infest. Lab., Slough, Bucks]

Observations were made on the storage under tropical conditions of raw and parboiled paddy and of native cleaned rice.—S.M.J.

1199 Godoy, O. P. and Toledo, F. F. Arroz. Amostragem para o estudo biométrico das espiguetas. [**Rice. Sampling for a biometrical study of the spikelets.**] *Lavour. arroz.* 1959, **13**, No. 154, 339–47, bibl. 8. [Esc. Sup. Agric. Luiz de Queiroz, Univ. São Paulo, Brazil]

In an investigation with the rice varieties Batatais, Dourado Agulha, Pérola and Pratão the average length, width and thickness of the spikelets were determined by measuring samples of 25, 50, 100 and 200 units. A statistical analysis of the data indicated that samples should contain at least 50 spikelets.—E.B.O.

1200 Zanzibar Protectorate. [**Rice trials.**] *Suppl. Ann. Rep. Dep. Agric., Zanzibar Protect. 1958.* 1960, 1-4.

The rice variety Red American gave significantly higher yields than the local variety Mngazija at 3 centres in Zanzibar. The optimum seed rate for machine-drilled rice, hand-weeded and grown in dry to semi-swamp conditions, was 80–100 lb./ac. The application of 3, 5 or 7 cwt. superphosphate/ac. resulted in increased paddy yields compared with rice receiving no P, but there was no significant difference between the 3 levels of applied P. Catch-cropping on the ridges with sweet-potatoes [*Ipomoea batatas*] or groundnuts resulted in an increase in yield of rice of about 200 lb. paddy/ac.—S.M.J.

1201 Green, V. E. and others. **Rice investigations.** *Ann. Rep. Fla Agric. Exp. Stas* 1958, 275–6.

In 5 years of varietal trials with rice at Belle Glade, Florida, Early Prolific gave the highest yields, followed by C.I. 9016, Sunbonnet, Nato, Toro, C.I. 9001, Bluebonnet, Lacrosse and Improved Bluebonnet. Hoja blanca has appeared in the Belle Glade area, and symptoms suggestive of this disease were found on *Echinochloa crus-galli*, *E. colonum*, *E. walteri*, *Brachiaria plantaginea*, *Panicum capillare*, *Digitaria sanguinalis* and *Sacciolepis striata*. —R.B.

GENERAL

1202 Müller, K.-H. Ergebnisse mehrjähriger Sommergetreidesortenversuche. [**Results of several years of spring-cereal varietal trials.**] *Z. landw. Vers.- u. UntersuchWes.* 1959, **5**, No. 1, 50–69, bibl. 1, English and Russian summaries. [Deutsche Akademie der Landwirtschaftswissenschaften zu Berlin, E. Germany]

The results of trials carried out during 1951–7 were classified according to cultivation zones, agricultural value of the soil, time of sowing, preceding crop and, where necessary, by soil types, rainfall, soil pH and nutrients. Of the spring wheats, Peko was the best in every grouping. Elsa was the best all-round barley variety, while Saale, though not giving high grain yields, is suitable for upland areas because of its short growing season. The best oat varieties were : Flämingsgold for N. Germany, Goldhafer II for Central Germany and Universal for all areas.—D.B.

1203 Petersen, H. I. Nogle ukrudtsbekæmpelsesmidlers virkning på kornarternes spiring, udbytte og kvalitet. [**The effect of some herbicides on the germination, yield and quality of cereals.**] *Tidsskr. Planteavl* 1959, **63**, No. 2, 197–284, bibl. 71, illus., English summary.

Trials were carried out on the effects of different concentrations of 2,4-D, MCPA and MCPB on wheat, rye and barley seedlings grown in pots, in small plots, and in yield trials. The butyl glycol ester of 2,4-D reduced germination and growth in barley. When ester and Na-salt formulations of the 3 herbicides were placed in open containers among germinating barley and vetch [*Vicia* sp.], MCPA (butyl glycol ester) and 2,4-D (ethyl ester) resulted in greater phytotoxicity from vaporization than did the Na salts of these herbicides. The rate of decomposition of MCPA was less in acid than in alkaline soil and the residual

effect of the herbicide lasted for 8 weeks. Pre-emergence applications of the Na salts of MCPA and 2,4-D reduced germination and shoot formation in wheat, barley and rye ; MCPB was less toxic than 2,4-D. Autumn or winter applications of herbicides to wheat retarded shoot formation. Applications of 4–16 kg a.i. MCPA or 2,4-D/ha caused a reduction in straw length. Applications of MCPB, MCPA and 2,4-D to the cereals between sowing and the 5- to 6-leaf stage resulted in abnormal spikelets and grain development and stem deformities. Applications of 1-2 kg 2,4-D a.i./ha to barley and oats resulted in a yield reduction, especially where applied to barley at the 1- to 2-leaf stage and to oats at the 3- to 4-leaf stage. Spraying in stubble fields in autumn with 4 kg 2,4-D a.i./ha increased barley yields the following year, but had a negligible effect on the weeds. Treatment with MCPA and 2,4-D in early spring increased the protein content of the seed. F. s.—S.M.J.

1204 Noda, A. and Hayashi, Z. **Studies on coleorhiza of cereals. 6.** [Japanese] *Proc. Crop Sci. Soc. Japan* 1959, **28,** No. 1, 17–19, bibl. 5, illus., English summary. [Kagawa Univ.]

The cereals investigated were Indian corn [*Zea mays*], sorghum [*Sorghum vulgare*], pearl millet [*Pennisetum typhoideum*], common millet, Italian millet [*Setaria italica*], barnyard millet [*Echinochloa crus-galli* var. *edulis*], finger millet [*Eleusine coracana*], and Job's tears [*Coix lachryma*]. F. Eng. s.—D.B.

1205† Strand, E. **Studies on the efficiency of experimental designs in small grain experiments.** *Acta agric. Scand.* 1959, **9,** No. 3, 321–40, bibl. 5. [Agric. Coll. Norway, Vollebekk]

The results are given of comparisons of the efficiency of the following experimental designs : (a) the row method with controls *v.* complete block and lattice designs, (b) the row method *v.* incomplete block designs, (c) complete blocks *v.* lattice designs. Factors affecting experimental error in field experiments with cereals are discussed.—P.J.B.

1206 Knipper, N. V. **Use of high-frequency currents for grain drying.** *Nauch. Trud. Elektrif. selkhoz.* 1956, **2,** 185–, bibl. 2. [Transl. cont. in] *J. agric. Engng Res.* 1959, **4,** No. 4, 349–60.

LEGUMES

SOYABEANS

See also Abs. 1197.

1207† Ballatore, G. P. La soia in Sicilia, [**Soyabeans in Sicily.**] *Ital. agric.* 1959. **96,** No. 8, 659–65, illus. [Ist. Agron., Univ. Palermo, Sicily]

An account is given of trials with soyabeans grown for seed in Sicily where this crop has potentialities when grown in spring/summer under irrigation. The best time for sowing was mid Apr.–early May. Medium-late varieties (the best were Lincoln and Hubert 33) yielded 1500–2000 kg of seed/ha and were more productive than the early varieties. The seed is used in Sicily for feeding cattle.—E.B.O.

1208 Weber, C. R. **Ford—a new soybean.** *Soybean Dig.* 1958, **19,** No. 2, 14–15, illus. [Iowa State Coll.]

1209 Hartwig, E. E. **Hill, a new early maturing soybean for the south [of the USA].** *Soybean Dig.* 1959, **19,** No. 10, 20–1, illus. [Delta Branch Exp. Sta., Stoneville, Miss.]

1210 Probst, A. H. and Athow, K. L. **Lindarin soybean for north Indiana.** *Soybean Dig.* 1958, **18,** No. 12, 7. [Dep. Agron., Purdue Univ.]

1211 Bernard, R. L. **Shelby, a new soybean variety.** *Soybean Dig.* 1958, **18,** No. 12, 6–7, illus. [Illinois Agric. Exp. Sta.]

1212 Soybean Digest. **Soybean varieties.** *Soybean Dig.* 1959, **19,** No. 3, 20–3, map.

Information is given on the principal soyabean varieties grown in various states of the USA.—E.B.O.

1213 Staniforth, D. W. and others. **Cultivation for weed control in soybeans.** *Soybean Dig.* 1959, **19,** No. 6, 6–8, illus. [Iowa State Coll.]

1214 Peters, E. J. and others. **Cultural treatments and herbicides for weed control in soybeans.** *Soybean Dig.* 1959, **19,** No. 5, 8–9. [Missouri Agric. Exp. Sta.]

1215 Peters, E. J. and others. **Rotary hoeing in combination with herbicides and other cultivations for weed control in soybeans.** *Weeds* 1959, **7,** No. 4, 449–58, bibl. 4. [Missouri Agric. Exp. Sta., Columbia]

Rotary hoeing was only moderately effective for controlling weeds and was unnecessary when pre-emergence herbicides had been used successfully. Such hoeing had its greatest effect where the weeds were very small, and was equally effective with either wet or dry soil. PCP at 20 lb./ac. was very successful as a pre-emergence herbicide provided the seed was not sown too shallowly, and led to increased yields of soyabeans. CIPC and dinoseb injured the soyabeans and CDAA was ineffective against weeds.—J.D.J.

1216 Nagata, T. **Studies on the differentiation of soybeans in the world, with special regard to that in Southeast Asia. 2. Origin of culture and paths of dissemination of soybeans, as considered by the distributions of their summer *vs.* autumn soybean habit and plant habit.** *Proc. Crop Sci. Soc. Japan* 1959, **28**, No. 1, 79–82, bibl. 24, illus., Japanese summary. [Hyogo Agric. College]

1217 Yamamoto, R. and Ishikawa, M. **Comparison between the soybean seeds ripened on a highland and those ripened on a lowland.** [Japanese] *Proc. Crop Sci. Soc. Japan* 1959, **28**, No. 1, 77–8, bibl. 4, English summary. [Nagoya Univ.]

Two varieties of soyabean (Daizu Norin No. 2 and No. 3) were grown at (a) a high and (b) a low altitude. The temperature difference between the upland and lowland localities was, on average, 5°C. In Daizu Norin No. 3, seeds which ripened at the higher altitude absorbed moisture and germinated more slowly than seeds which ripened at the lower locality. Seeds of Daizu Norin No. 2 exhibited no such difference. In both varieties in each of 8 years, seeds produced at the high altitude contained more sugar and less oil than seeds produced on the lower land, but differences in their protein content were not significant. These differences in chemical composition are attributed to the different mean temperatures at the 2 locations. F. Eng. s.—D.B.

1218 Perkins, H. J. and others. **A tissue-autoradiographic study of the translocation of C^{14}—labelled sugars in the stems of young soybean plants.** *Canad. J. Bot.* 1959, **37**, No. 5, 871–7, bibl. 21, illus. [Div. Appl. Biol., Nat. Res. Coun., Ottawa, Ontario]

1219 Tanganyika Agricultural Corporation. **Rufiji Basin Survey Scheme. Trial farms [Legumes].** *Rep. Tanganyika agric. Corp.* 1957–8, 92–3. [Received Jan., 1960]

At Rujewa, application of 112 lb. triple superphosphate/ac. increased yield of soyabeans from 300 to 700 lb./ac., but had no effect on groundnut yields. Dec. was the optimum sowing month for both crops.—A.M.H.

GROUNDNUTS

See also Abs. 1219

1220 Smartt, J. **Groundnuts in Northern Rhodesia.** *Rhod. agric. J.* 1960, **57**, No. 1, 69–72, bibl. 2.

The production of groundnuts in N. Rhodesia is described.—S.M.J.

1221 Ginouves, J. Note sur un essai de dates de décorticage de l'arachide. [**A note on the effect of date of shelling groundnuts for seed.**] *Bull. agron. Fr. d'out mer* 1959, No. 16, 123–6.

In Senegal shelling groundnuts for sowing presents a problem because its date coincides with that of soil cultivation. In a trial to study the effect of shelling date on the germinating capacity of the seed, 6 lots (50 kg each) of pods of the groundnut variety 28–206, were shelled on the first day of each month from January to June, the latter being the normal month for shelling. The seeds were treated with the fungicide vérisan, 2 parts per 1000, and the insecticide HCH [= BHC], 2 per 1000. In the laboratory, both the germinating energy and germinating capacity, tested at the end of June (sowing date) and later, did not vary greatly between lots. In the field there were some significant differences in emergence between the various lots, but the differences in yields, which varied from 1305 to 1405 kg/ha, were not significant. It is concluded that groundnuts can be shelled safely several months before sowing, provided the seed is treated with a fungicide and an insecticide.—E.B.O.

1222 ter Horst, K. Peulvruchten. [**Pulse crops.**] *Jaarversl. LandbProefst. Suriname 1958* 1959, 32–40.

Groundnuts were grown at densities varying from 67–330 thousand plants/ha. Yields of dry pods increased linearly with plant density up to 100 thousand plants/ha, but at greater densities the increase in yield scarcely offset the additional quantity of seed required. The ratio of dry pods to dry-matter yields of tops was 1 : 2·5 for plants sown in Aug. and 1 : 6 for plants sown in Jan. In fertilizer trials, groundnuts given 200 kg 5-10-10 (NPK) and 50 kg $MgSO_4$ monohydrate/ha yielded 25% more dry pods than did unmanured controls. It was concluded that 2 completely independent factors limit groundnut yields, one of which is nutrient shortage. Varieties of groundnuts, soyabeans and cowpeas under test in 1956–8 are given.—R.B.

1223 Niqueux. Choix de variétés d'arachides au Tchad. [**Choice of groundnut varieties in Chad (French Equatorial Africa).**] *Agron. trop., Paris* 1959, **14**, No. 4, 490–502, illus., English and Spanish summaries.

An account is given of trials, which started in 1956 and are still in progress, to find groundnut varieties suitable for Chad. Several varieties, mostly from Bambey, Senegal, were tested at Dilbini Farm and other localities, in a comparison with local varieties. Results showed that the erect varieties Bambey 28–206 and Volètes yielded considerably more nuts than the creeping varieties (both local types and selected types from Senegal). In 1957, a year of high rainfall, the erect varieties yielded 20% more, and in 1958, a year of low rainfall, about 50% more than the creeping varieties. However, Rose du Cameroun (Volète type) is

considered the best variety for the most northern and driest part of the territory, in areas which receive sufficient rainfall for growing groundnuts; south of this area the Volètes varieties are best ; Bambey 28–206 is superior to the others south of the 800 mm isohyet only. An account is also given of intercropping trials of groundnuts with sorghum.—E.B.O.

1224 CARVER, W. A. **Peanut breeding for superior types for market and for livestock feed.** *Annu. Rep. Fla agric. Exp. Stas* 1958, 45.

The quality of Dixie Runner and Early Runner groundnut seed was better than that of all other varieties tested. During 1954–7, N.C.2 outyielded Dixie Runner by 18% and Early Runner by 2%, but yielded 6·2 times more damaged seed than either variety. Florispan Runner outyielded N.C.2 by 14% and produced 71% less damaged seed.—R.B.

1225 BURT, E. O. **Herbicidal control of weeds in peanuts.** *Annu. Rep. Fla agric. Exp. Stas* 1958, 58–9.

In 2 experiments with 52 herbicidal treatments applied before groundnut emergence, very good weed control was given by 9 or 12 lb. dinoseb/ac., 1 lb. diuron/ac., 1 or 2 lb. 2,4-D or 2,4-D amide/ac., 8 lb. 3,4-DMB/ac., 2 lb. 3Y9/ac., 8 or 12 lb. CDEC/ac., 2·5 lb. EPTC/ac., 4 or 6 lb. 2,4-DEB/ac., 8 lb. NPA/ac., or 6 lb. dinoseb + 6 lb. CIPC/ac., with little or no damage to the crop. In post-emergence treatments, dinoseb at 3 lb./ac. with or without 2 lb. 2,4-DES/ac., killed all annual weeds when applied at the 2- to 3-leaf stage of the weeds. Treatment caused some damage to the leaves of the crop, but resulted in higher yields than those from normally cultivated plots.—R.B.

1226 PARKER, C. **Weed control in groundnuts with particular reference to MCPB and 2,4-DB.** *Proc. Afr. Weed Contr. Conf., S. Rhodesia July 1958* [n.d.] 212–9, bibl. 9.

Difficulties in securing adequate weed control in groundnuts are discussed and spp. susceptible to different rates of 2,4-DB and MCPB are given.—S.M.J.

1227 HERFORD, G. V. B. **Control of insects infesting groundnuts.** *Annu. Rep. Pest Infest. Res. Bd 1958* 1959, 17–18. [Pest Infest. lab., Slough]

In experiments on the control of *Tribolium castaneum*, sacks filled with fumigated (fumigant not given), decorticated groundnuts were treated with lindane and malathion (wettable powders, a.e. not given) at 40 and 80 mg/sq.ft. and DDT at 100 and 200 mg/sq.ft. Sacks were stored individually and infected with *T. castaneum* at 2-weekly intervals. No single spraying gave adequate control, but 4-weekly applications of 80 mg malathion/sq. ft. gave almost complete control.—S.M.J.

1228 CATHERINET, M. Quelques données sur la germination de l'arachide. Étude de la température optimum. [**Some data on the germination of groundnuts. Study of the optimal temperature.**] *Bull. agron. Fr. d'out. mer* 1959, No. 16, 93–8, bibl. 22. [Centre Rech. Agron., Bambey, Senegal]

In the test described, seeds of the groundnut variety 28–206 were germinated at temperatures of 18°–48°C. The best germination was obtained between 24° and 38°, the optimal temperature being about 32°. After 2 days at this temperature, the germination percentage was nearly 100%.—E.B.O.

1229 SESHADRI, C. R. **Studies on root development in groundnut.** *Indian J. agric. Sci.* 1958, **28**, No. 2, 211–15, bibl. 11. [Agric. Res. Sta., Tindivanam, South Arcot District, Madras]

1230 SESHADRI, C. R. and others. **Studies on the branching pattern in groundnut (*Arachis hypogaea* Linn).** *Indian J. agric. Sci.* 1958, **28**, No. 2, 175–80, bibl. 12, illus. [Agric. Res. Sta., Tindivanam, Madras]

1231 WORMER, T. M. and OCHS, R. Humidité du sol, ouverture des stomates et transpiration du palmier à huile et de l'arachide. [**Soil moisture, opening of the stomata and transpiration of oil palm and groundnuts.**] *Oléagineux* 1959, **14**, No. 10, 571–80, bibl. 15. [Sta. Exp. Pobé, Dahomey, French West Africa]

A summary is given of the results from many trials to study the behaviour of groundnut plants under natural conditions in relation to soil moisture (the only environmental factor which was controlled). It was found that : (a) when the soil moisture decreased from field capacity, the transpiration of groundnuts remained constant until the soil moisture reached a critical value, dependent on climate, beyond which the transpiration decreased gradually up to wilting point ; near this point it was still 66% of the maximum transpiration ; (b) the extent to which the stomata were open during the soil-drying followed a parallel course to that of transpiration ; the stomata were completely open until the critical soil moisture value was reached ; beyond this point they closed gradually, although they were still partially open near the wilting point ; (c) the changes in the extent to which the stomata were opened was influenced by soil moisture, intensity of transpiration and intensity of light ; (d) the water deficit in the leaf tissues was nil early in the

morning and then increased rapidly until it reached a stable value of about 10% of saturation ; this behaviour was not affected by soil moisture until the wilting point was almost reached, when the deficit increased rapidly ; with a water deficit as high as 40%, groundnut plants recovered rapidly after irrigation water was applied.—E.B.O.

1232 SIVADJIAN, J. Dosage hygrophotographique de la transpiration de l'arachide. Ses variations normales et provoquées. [**Hygrophotographic determination of transpiration in groundnuts. Its normal, and induced, variations.**] *Oléagineux* 1960, **15**, No. 1, 1–4, bibl. 3, illus. [Inst. Pasteur, Paris]

[For a previous study on the subject see *Fld Crop Abstr.* 12 : 1313.] This paper gives quantitative results from an investigation in the summer of 1959. In groundnut leaves, transpiration was more abundant from the upper surface than from the lower surface. In shade, the leaflets were arranged horizontally, in full sunshine they became erect and thus reduced the increase in transpiration which for both surfaces did not exceed 0·5 μg per min./mm^2 of surface. Treatment of the leaflets with an organo-silicic preparation inhibited transpiration and retarded their nyctinastic movements.—E.B.O.

1233 CATHERINET, M. Observations sur quelques caractéristiques de la fleur d'arachide. [**Observations on some characteristics of the groundnut flower.**] *Bull. agron. Fr. d'out. mer* 1959, No. 16, 99–105, bibl. 8, illus. [Centre Rech. Agron., Bambey, Senegal]

[See also *Fld Crop Abstr.* 10 : 571.]

1234 MIZUNO, S. **Physiological studies on the fructification of peanut. 1. Distribution of radioactive calcium administered to the fruiting zone in the fruiting organ.** [Japanese] *Proc. Crop. Sci. Soc. Japan* 1959, **28**, No. 1, 83–5, bibl. 9, illus., English summary. [Hyogo Univ. Agric.]

1235 LÉVÈQUE, L. A. and BELEY, J. Contribution à l'étude de la nutrition minérale de l'arachide (*Arachis hypogaea*). Effets de toxicités borique et manganique. [**A contribution to the study of the mineral nutrition of groundnuts (*A. hypogaea*). Effects of B and Mn toxicities.**] *Agron. trop., Paris* 1959, **14**, No. 6, 657–710, bibl. 13, illus., English and Spanish summaries. [Centre Tech. Agric. Trop., Nogent-sur-Marne, France]

The results are given from 2 trials carried out with plants of the groundnut var. 28–204 (Volète type) from Bambey, Senegal. It was concluded that the optimal concentration of B in the nutrient solution was at least 0·75 ppm., the threshold of B toxicity being close to, but lower than, 3 ppm. ; the optimal concentration of Mn was higher than 0·2 ppm., the threshold of Mn toxicity being 5 ppm. The effects of toxic amounts of B and Mn on the plants are described. [See also *Fld Crop Abstr.* 10 : 573.]—E.B.O.

1236 GILLIER, P. Utilisation du diagnostic foliaire pour la cartographie des besoins en engrais de l'arachide au Sénégal. [**Use of foliar diagnosis for mapping the fertilizer requirements of groundnuts in Senegal.**] *Oléagineux 1960*, **15**, No. 3, 147–51, bibl. 3, maps.

Using data from manurial trials and foliar diagnoses of groundnuts, a map was drawn of the Thiès region of Senegal showing areas with an excess of P in the soil. The fertilizers recommended for growing groundnuts in these areas are : 50 kg sulphate of ammonia and 50 kg potassium chloride per ha.—E.B.O.

1237 DEPARTMENT OF AGRICULTURE, NYASALAND. **A summary of some aspects of agricultural experimental work, 1958-59. Groundnuts.** [Cont. in] *Nyasaland Fmr Frstr* 1959, **5**, No. 1, 6–7.

Weeding trials (by hoeing) with 3 varieties of groundnut at Chitedze showed that as from the second week after germination, each delay of 1 week in the 1st weeding resulted in a loss of 70 lb. decorticated nuts/ac. in A.R.S. Spanish (Red Valencia), 40 lb./ac. in Mwitunde and 65 lb. in Dixie Runner. Only Mwitunde and Dixie Runner responded to more than 2 hoeings with yield increases of 100 and 200 lb./ac., respectively. In herbicide trials, yields of 1700 lb. decorticated nuts/ac. were obtained from plots sprayed with 2 lb. a.i. 2,4-D in 100 gal. water, followed by hand-weeding in mid-Jan.—S.M.J.

PEAS

1238 BARTZ, J. F. **Yield and ovule development of Alaska peas as influenced by nutrition and soil moisture.** *Diss Abstr.* 1959, **20**, No. 3, 834–5. [Univ. Wisconsin, Madison]

In glasshouse studies on the effect of P nutrition on fruiting in Alaska canning peas, about two-thirds of the P in the peas at canning maturity was derived from the nutrient substrate and the remainder was P transferred from other plant organs. Under conditions of low P supply, foliar applications increased the P content of the peas and, though the effect on yields was not consistent, such treatments had more effect on pod numbers per plant than on pea numbers per pod. In field trials, applications of P fertilizers increased pea yields by more than 600 lb./ac., compared with 200 lb./ac. for foliar P treatments. Where P was applied to the soil, foliar P had no effect on yields. In growth chamber studies, low levels of soil

moisture during flowering to maturity decreased pod fill more than did low levels of moisture from emergence to maturity.—P.J.B.

1239 Danielson, C. E. **Chemical analyses of ripening peas.** *Physiol. Plant.* 1959, **12**, No. 1, 176–82, bibl. 6.

The monosaccharide and sucrose contents of ripening pea seed, which had been preserved in ethanol immediately after harvest for 18 months, was investigated. Sucrose content increased linearly with moisture content of the seeds during ripening. Sucrose, monosaccharide, and dry matter contents for different harvest dates are tabulated.—S.M.J.

BEANS

1240 Detroux, L. Le désherbage des cultures de légumineuses à grosses graines. [**Weeding of large-seeded legume crops.**] *Rev. Agric., Brux.* 1959, **12**, No. 7–8, 691–5, bibl. 3. [Sta. Phytopharm. État, Gembloux, Belgium]

It is concluded that some chemical preparations are available for the control of annual weeds in large-seeded legume crops, but that none is available for the control of perennial weeds. With regard to field beans, it is recommended to apply neburon at 1·5–2·5 kg of active material per ha before emergence, and/or DNBP at 600–800 g/ha after emergence.—E.B.O.

1241 Evans, L. T. **Environmental control of flowering in *Vicia faba* L.** *Ann. Bot., Lond.* 1959, **23**, No. 92, 521–46, bibl. 22. [Earhart Lab., Calif. Inst. Tech.]

There is a heteroblastic change in leaflet number in many stocks of *V. faba*, the rate of change being affected by temperature and photoperiod. In all except the earliest flowering stocks, and particularly at high temperatures, flower initiation shows a quantitative long-day response. Flower initiation may be accelerated in all except the earliest flowering stocks of *V. faba* by brief exposures to low temperatures, particularly when the plants are grown in short days at high temperatures. The response to low temperatures is more rapid at 10°C. than at 4°C. but eventually approaches saturation at both temperatures. More prolonged exposure to low temperatures delays flower initiation. The response to low temperatures increases with increasing plant age but can occur during embryo development on the mother plant. At temperatures above 14°C., and particularly above 23°C., a reaction inhibitory to flower initiation occurs. This reaction is operative at all stages of the life cycle. Its inhibitory effects may be overcome by subsequent cold treatment ; when the low temperature processes have reached saturation, subsequent high temperatures are no longer inhibitory. Although nucleosides could accelerate flower initiation, purine and pyrimidene analogues did not, with one exception, reduce the response to low temperature treatment. F. s.—M.H.

1242† Ahmed, M. B. **The effect of the presence and absence of phosphorus at different periods of growth of *Vicia faba*.** *Indian J. agric. Sci.* 1958, **28**, No. 1, 43–56, bibl. 9. [Cairo Univ., Egypt]

The critical period for P manuring of *V. faba* was the 3rd–9th week after sowing. During this period the plant absorbed sufficient P for normal growth throughout its life, and for seed production. Supplies of P after the 9th week did not increase dry matter ; they merely increased P content. F. s.—D.B.

VOANDZEIA SUBTERRANEA

1243 Department of Agriculture, Nyasaland. **A summary of some aspects of agricultural experimental work. Ground beans.** [Cont. in] *Nyasaland Fmr Frstr* 1959, **5**, No. 1, 7.

Plots of ground beans (nzama) [*Voandzeia subterranea*] sown on 24 Jan. and harvested 118 days later yielded 20% less than crops sown on 11 Dec. and lifted 146 days later.—S.M.J.

1244 Ferrão, J. E. M. and Xabregas, J. Valor alimentar da *Voandzeia subterranea* Thouars. [**Nutritive value of *V. subterranea*.**] *Agron. angol.* 1957–9, No. 11, 3–23, bibl. 27, illus. [Inst. Sup. Agron., Lisboa, Portugal]

CAJANUS CAJAN

1245 Khan, M. Q. and Ramasubbaiah, K. **Bionomics and control of gram caterpillar.** *Andhra agric. J.* 1959, **6**, No. 2, 68–9, bibl. 3. [Agric. Res. Inst., Rajendranagar, India]

In trials to control *Heliothis armigera* on red gram [*Cajanus cajan*], 0·16% DDT (1·5 lb./acre) killed all the caterpillars in 12 hr. ; 0·31% DDT killed them all in 6 hr. BHC was much less effective than DDT.—D.B.

LUPINS

1246 Garay, A. S. and others. **Photoperiodic and thermoperiodic control of indoleacetic acid oxidase in *Lupinus albus* L.** *Physiol. Plant.* 1959, **12**, No. 4, 799–808, bibl. 32, illus. [Inst. Pl. Breed., Fertöd, Hungary]

Under conditions of continuous illumination, flowering of *Lupinus albus* began 18–30 days earlier, and fewer leaves were produced before flowering than with similar plants given 8 hr. illumination. IAA oxidase content was highest in plants grown with 8 hr. illumination. A night temperature of

25°C. and high light intensity (9000 lux) increased the synthesis of IAA oxidase inhibitor.—S.M.J.

1247 Steveninck, R. F. M. van. **Factors affecting the abscission of reproductive organs in yellow lupins (*Lupinus luteus* L.). 3. Endogenous growth substances in virus-infected and healthy plants and their effect on abscission.** *J. exp. Bot.* 1959, **10,** No. 30, 367–76, bibl. 12. [DSIR, Christchurch, N. Zealand]

See also *Fld Crop Abstr.* 12 : 1820.

GENERAL

1248† Lechner, L. Über die Sortenleistung von Feldhülsenfrüchten auf Grund mehrjähriger Landessortenversuche in Bayern (1950–1957). [**The productivity of varieties of field legumes based on several years' trials with land varieties in Bavaria (1950-57).** *Bayer. landw. Jahrb.* 1959, **36,** No. 4, 460–511. [Landessaatzuchtanst. Weihenstephan, Bavaria, W. Germany]

A report is given of cultivation trials with several land varieties of *Vicia faba*, *V. sativa*, *Pisum sativum*, *P. arvense*, *Lupinus luteus*, *L. angustifolius* and *L. alba*. The varieties of each species were assessed on the basis of yields of seed and straw, and on quality.—D.B.

1249† Neme, N. A. Leguminosas para adubos verdes e forragens. [**Legumes for green manure and forage (in Brazil).**] *Bol. 109 Inst. agron. Campinas, São Paulo* 1959, pp. 28.

Information is given on annual and perennial species of legumes grown as green manures in São Paulo, Brazil.—E.B.O.

1250† Almeida, J. M. As "orobancas" comprometem a cultura de algumas leguminosas. [**Broom-rape hinders the growing of some legumes.**] *Agricultura, Lisboa* 1959, No. 3, 35–6, illus. [Esta. Agron. Nac., Sacavém, Portugal]

Cultivated legumes are divided into 4 groups, according to their susceptibility to broom-rape (*Orobanche crenata*). *Vicia faba*, *V. narbonensis*, *Lathyrus sativus* and *Pisum sativum* are highly susceptible.—E.B.O.

ROOT CROPS

SUGAR-BEET

See also Abs. 1162

1251 De Suikerbiet. Zaad en zaaien. [**Seed and sowing.**] *Suikerbiet* 1960, **13,** No. 7, 53–63.

The properties of untreated, graded, rubbed and monogerm sugar-beet seed of diploid, triploid and polyploid varieties are discussed. Relative and actual seed rates are given for 2 row-spacings and 6 spacings within the row.—R.B.

1252 Jordan, Hashemite Kingdom of. **Sugar beets.** *7th Ann. Rep. Deir Alla Res. Sta.* 1958, 41–9.

In varietal and sowing-date trials, the varieties U.S. 400, Johnson E and Kuhn R were the best of 8 types tested ; sowing on 20 Oct. is preferable to sowing on 15 or 23 Nov., the mean sugar percentage in the crop from the Oct. sowing being 14·5% higher than from the later sowing. Spacing trials have shown that 50× 25 cm or 50× 20 cm are preferable to 50 × 10 cm.—M.H.

1253 Grimes, D. W. **Effect of crop rotation, manure and commercial fertilizers upon yield, percent sugar and gross sugar production of sugar beets in southwestern Kansas.** *J. Amer. Soc. Sug. Beet Technol.* 1959, **10,** No. 4, 364–70, bibl. 5. [Garden City Br. Exp. Sta., Kansas Agric. Exp. Sta., Manhattan]

The following crop rotations were practised on clay loam soil of pH 8 : (a) 3 yr. lucerne/grain sorghum/sugar-beet/spring oats/winter wheat ; (b) as (a) except that grain sorghum, oats/sweet-clover and sweet-clover replaced lucerne ; (c) as (a) except that winter wheat, grain sorghum and sugar-beet replaced lucerne. F.y.m. at 10 tons/ac. was applied on half of each plot during the 5th yr. of all rotations and during the 7th yr. of rotation (a), the first yr. of rotation (b) and the second yr. of rotation (c). P was applied at 0 or 40 lb./ac./yr. N was applied at 0 or 40 lb./ac./yr. to all crops except legumes. Yields of roots/ac., but not sugar yields, were significantly increased by including legumes in the rotation. F.y.m. significantly increased yields of sugar/ac., especially in rotation (c). N + P increased sugar yields by 5·2 cwt./ac., compared with plots not receiving N or P. Legumes, fertilizer N and f.y.m. significantly reduced the percentage sugar in the roots.—R.B.

1254 Haddock, J. L. **Yield, quality and nutrient content of sugar beets as affected by irrigation regime and fertilizers.** *J. Amer. Soc. Sug. Beet Technol.* 1959, **10,** No. 4, 344–55, bibl. 6. [Utah Agric. Exp. Sta., Logan]

Sugar-beet was grown in a 5-yr. rotation of peas, 2 yr. lucerne and potatoes on calcareous loam and given 80 lb. N and 44 lb. P/ac. and furrow or sprinkler irrigation, water being applied when soil moisture was depleted to 90, 70, 40 or 20% of that available at field capacity. Yields of tops, the top : root ratio and the NO_3-N and Na content of petioles were greater under sprinkler than furrow irrigation. Increasing the amount of available soil moisture increased root yields, percentage sucrose, sucrose purity and the P con-

tent of petioles, and decreased yields of tops and the NO_3-N and Na content of petioles. Fertilizer increased yields at the 2 highest soil moisture levels and depressed yields at the lowest soil moisture level. The minimum level of available soil P for successful sugar-beet growing on this soil was estimated to be 25 ppm.—R.B.

1255 THOMPSON, E. G. **Trials of commercial varieties of sugar beet.** *Brit. Sug. Beet Rev.* 1959, **27**, No. 4, 155–7. [Nat. Inst. Agric. Bot., Cambridge]

Tables show yields of sugar, roots and tops, and percentages of sugar in the roots and of bolters at harvest, of 16 varieties tested in 1956–8. [See also *Fld Crop Abstr.* 12 : 207.]—E.B.O.

1256 THOMPSON, E. G. **Bolting in early sown sugar beet. Comparison of varieties, 1958.** *Brit. Sug. Beet Rev.* 1958, **27**, No. 2, 63–4. [Nat. Inst. Agric. Bot., Cambridge]

The incidence of bolting in 1958 varied greatly between centres, but the average total incidence was only a little lower than in 1957 [see *Fld Crop Abstr.* 11 : 638] and the proportion of early bolters, which cause the greatest loss of sugar, was substantially lower. The varieties which gave the lowest average percentages of early and total bolters were, in alphabetical order : Battle's E, Bush E, Bush N, Cambro, Johnson's N, Sharpe's Klein E and Sharpe's Klein Polybeet.—E.B.O.

1257 WILLEY, L. A. **Bolting in early sown sugar beet.** *Brit. Sug. Beet Rev.* 1959, **28**, No. 2, 66–7. [Nat. Inst. Agric. Bot., Cambridge]

A table shows the average percentages of bolters in the sugar-beet varieties grown in Great Britain in 1959, when the incidence of bolting was relatively low. Figures for the 2 previous years are also given. Cambro continued to give the lowest percentage of bolters.—E.B.O.

1258 MURANT, A. F. **Use of herbicides in sugar beet.** *Brit. Sug. Beet Rev.* 1959, **27**, No. 3, 115–18, illus. [Norfolk Agric. Sta., Sprowston]

This article reviews the current usage of herbicides in sugar-beet crops and indicates possible future lines of development.—E.B.O.

1259 DETROUX, L. and WAUTHY, R. Essais de désherbage sélectif des champs de betteraves effectués en 1958. [**Trials in 1958 on the chemical weeding of sugar-beet fields.**] *Publ. tech. Inst. belge Amélior. Better.* 1959, **27**, No. 1, 3–25, illus., English and Flemish summaries.

An account is given of 2 trials carried out at Tirlemont, Belgium, to test several chemical herbicides (dusts or sprays) applied to sugar-beet either before sowing, or before or after emergence. Monogerm sugar-beet seed was sown on 16 Apr. at a rate of 12 kg/ha. Tables show the number of the various weed species present per m^2, also the yields of roots, sugar and tops of sugar-beet, with the various treatments. The main conclusions were that solutions and emulsions of PCP, neburon at 0·555 kg active material/ha, DCU and nitrate of soda did not reduce the yields of sugar and gave good control of the weeds.—E.B.O.

1260 COMMISSIE TER BEVORDERING DER SUIKERBIETENTEELT IN DE NOORDELIJKE PROVINCIËN. Chemische bestrijding van wilde haver in suikerbieten. [**Chemical control of wild oats in sugar-beet.** *Meded. Inst. rat. Suikerprod.* 1959, **29**, No. 3, 70–3, illus.

The following treatments were applied in experiments to control wild oats [*Avena fatua*] in sugar-beet, var. Hilleshög standard polyploid : (a) 30 kg dalapon/ha at the beginning of wild-oat germination, 14 days before sowing sugar-beet, (b) 5 kg propham + 8 kg dalapon/ha 14 days before sowing, (c) 15 kg DCU/ha 6 days before sowing, (d) 14 kg dalapon/ha when the sugar-beet had 2–4 leaves, (e) 7·5 kg propham/ha 14 days before sowing plus 5 kg propham/ha at the 2–4 leaf stage. Treatment (a) gave almost complete control of *A. fatua* and *Agropyron repens* and treatment (b) fairly good control. Singling the untreated plots took 15 times longer than singling plots of treatment (a). All dalapon treatments caused some phytotoxicity to the beet, but later in the season only those given treatment (d) appeared to have suffered a setback in growth. Treatments (a), (b) and (c) yielded rather better, and treatment (d) rather worse, than untreated beets.—R.B.

1261 COMMISSIE TER BEVORDERING DER SUIKERBIETENTEELT IN DE NOORDELIJKE PROVINCIËN. Onkruidbestridjing met I.P.C. [**Weed control with propham.**] *Meded. Inst. rat. Suikerprod.* 1959, **29**, No. 3, 73–6.

Sugar-beet at the 4-leaf stage was sprayed with 5 or 7·5 kg propham in 800 l water/ha. *Stellaria media* and *Polygonum persicaria* were well controlled, especially at the higher rate of propham, but *Galeopsis* spp. were not affected. Yields of sugar and of roots, but not of tops, from sprayed plots were less than those from hand-weeded plots, but greater than those from unweeded plots. Some recent experiments on weed control using propham are reviewed. It is recommended that it be used only in cases of heavy infestation with *Poa annua* or *Alopecurus myosuroides*, and should be applied (a) at 7·5 kg/ha 14 days before sowing, or at 5 kg/ha, (b) 5–7 days before sowing and before preparing the seed-bed, or (c) just before singling. Treatment (c) gave good control of *Matricaria chamomilla*, *S. media* and *Fumaria officinalis*, but reduced sugar yields by 300 kg/ha.—R.B.

1262 Johnson, R. T. and Burtch, L. M. **The problem of wild annual sugar beets in California.** *J. Amer. Soc. Sug. Beet Technol.* 1959, **10**, No. 4, 311–17, bibl. 2. [Spreckels Sugar Co. Woodland, California]

Volunteer sugar-beet in California appear to have evolved into annual forms, partly because of the effects of dry summer weather in selecting against slow bolters. These annuals are indistinguishable from sown sugar-beet until after singling. Stands of these plants along roads and waste places may act as reservoirs of disease. 2,4-D butyl ester at 1250–2500 ppm. applied as a foliar spray to run-off, gave good control of volunteer beet plants on roadsides. Monuron at 20–40 lb./ac. completely controlled volunteer beet throughout the growing season.—R.B.

1263 Darpoux, H. and Lebrun, A. Essais de désinfection des glomérules de betterave. [**Trials in disinfecting sugar-beet seeds.**] *Publ. Inst. tech. franç. Betterave industr. Travaux effectués en 1958* [n.d.], 33.

Eleven fungicidal dusts were tested for disinfecting sugar-beet seeds which had been inoculated with a mixture of *Phoma betae*, *Rhizoctonia solani* and *Fusarium* sp. The seed was sown in early July. The most effective dust, as shown by the number of seedlings 5 weeks later, was an organo-mercury preparation (673 seedlings), followed by PCNB (628 seedlings), in comparison with 363 seedlings from the inoculated but untreated control. Several other dusts also gave good results.—E.B.O.

1264 Donà dalle Rose, A. Attività sperimentale della Stazione di Bieticoltura. 1958, 1959. [**Experimental work at the Station for Beet Cultivation. 1958-9.**] *Publ. 58 and 66 Rovigo, Italy, Sta. sper. Bieticolt.* 1959 and 1960, pp. 55 and 46, bibl. in text, illus. [Received Feb., 1960]

In a trial in 1959 to compare 40 sugar-beet types (34 foreign and 6 Italian), 50% of which were polyploids, the highest yields of sugar per ha were obtained from Alba P (7732 kg) and P I (Sel. Maribo pol.) (7425 kg). In a trial to control the nematode *Heterodera schachtii*, soil treatment with DD applied at 200 and 400 kg/ha, 4 weeks before sowing sugar-beet, gave yields of sugar of 2150 and 2618 kg per ha, respectively, compared with 1036 from the untreated control. In a trial to compare several preparations for the control of *Cercospora beticola*, brestan 20% at 0·4 kg Sn/ha, was best and gave the highest yield of sugar per ha (9302 kg).—E.B.O.

1265 Allen, W. R. and others. **Relation of sugar-beet root maggot control by insecticides to sugar beet yield.** *J. Amer. Soc. Sug. Beet Technol.* 1959, **10**, No. 4, 330–4, bibl. 5. [Can. Dep. Agric., Winnipeg, Manitoba]

Sugar-beet, var. Kleinwanzleben N, was sown at 6 lb. seed/ac. on 24 May 1957 and given 80 lb. 11-48-0 (NPK) fertilizer/ac. plus (a) heptachlor or aldrin at 1 lb./ac. as impregnated fertilizer, or as granules mixed with the fertilizer, (b) heptachlor, aldrin or dieldrin as a seed treatment at 1 lb. insecticide/100 lb. seed. All insecticidal treatments significantly reduced stands. Heptachlor-impregnated fertilizer was the most phytotoxic and reduced stands by 60%. Seed treatments were significantly less phytotoxic than insecticide/fertilizer mixtures. There were no significant stand differences after singling. All insecticide/fertilizer mixtures significantly reduced the number of larvae of *Tetanops myopaeformis* per plant. The number of large roots, mean weight 1·61 lb., and small roots, mean weight 0·68 lb., were determined at harvest. All impregnated fertilizers, fertilizer plus granulated heptachlor, and heptachlor seed treatment significantly increased the percentage of large roots at harvest and the yield of roots/ac., compared with controls not treated with insecticides. Insecticide treatments had no significant effect on the percentage sugar in the roots.—R.B.

1266 Parry-Williams, J. B. **Comparisons of fluoroacetamide against sugar beet aphids with three other insecticides, 1959.** *Tech. Bull. BDHA/1 Harper Adams Agric. Coll.* 1959, pp. 15, bibl. 6.

In trials in 1959 to control sugar-beet aphids (*Aphis fabae* and *Myzus persicae*), metasystox (55% a.i.) and megatox (fluoroacetamide), applied at 35 gal./ac. were more efficient than rogor (40% spray) and schradan (55% a.i.), but plots sprayed with rogor gave the highest yields, 16·43 ton/ac. (3·18 ton sugar/ac.) compared with 9·36 ton/ac. (1·75 ton sugar/ac.) for unsprayed plots.—S.M.J.

1267 Münster, J. and Joseph, E. La lutte contre la jaunisse de la betterave à l'aide de produits systémiques s'impose-t-elle ? [**Is it necessary to control beet yellows with the help of systemic insecticides ?**] *Rev. rom. Agric.* 1959, **15**, No. 11, 89-91, bibl. 3. [Stat. Féd. d'Essais Agric., Lausanne, Switzerland]

Sugar-beet yellows is a growing menace in French Switzerland where it first appeared in 1950. In addition to cultural measures such as early sowing, delayed singling and high plant-density, the preventive treatment tested and recommended consisted of applying ekatine (thiometone) at 2 l/ha at the 3–4 leaf stage and 10–15 days later at 1 l/ha. Since 1959, the use of ekatine has been authorized in Switzerland up to 30 June. Analysis of plants 1 month after treatment revealed no trace of toxic residues either in the root or tops and the latter could be used as fodder in the autumn. The treatment did not reduce sugar content, and sugar

yields increased with root yields. Increased financial returns outweighed increased costs.—D.B.

1268 Sylvester, E. S. and others. **Field evaluation of demeton in the control of beet yellows virus.** *J. econ. Ent.* 1959, **52**, No. 5, 910–17. [Univ. California, Berkeley]

Sugar-beet grown at 3 locations was treated with demeton at weekly intervals between 21 Feb. and 6 May 1958 at rates progressively increasing from 2 to 8 oz./ac. *Myzus persicae* appeared in early Feb. and died out in mid-May. Spraying confined the aphid infestation to the younger leaves, and the insecticide did not appear to be readily translocated. Virus yellows appeared in early April and spread rapidly through the crop in spite of insecticide treatments. Treatment delayed 100% infection for up to 3 weeks, and significantly increased the yield of roots at 2 locations and the percentage sugar content at all locations.—R.B.

1269 Donà dalle Rose, A. and Breccia, A. Facoltà germinativa del semebietole sottoposto a radiazioni ionizzanti. [**Germinating capacity of sugar-beet seed subjected to ionizing radiations.**] *Sementi elette* 1959, **5**, No. 6, 27–35, bibl. 2, illus., English and German summaries. [Sta. Sper. Bieticolt., Rovigo, Italy]

In small-scale trials diploid sugar-beet seed was treated with ionizing radiations from ^{60}Co. This treatment reduced the time taken to germinate and increased the speed of growth of the seedlings. The yields of roots and sugar of the plants from treated seed were greater than those of the controls. —E.B.O.

1270 Snyder, F. W. and Wiant, D. E. **Effect of high energy electron irradiation on respiration of whole sugar beet roots.** *J. Amer. Soc. Sug. Beet Technol.* 1959, **10**, No. 4, 356–8, bibl. 1. [Michigan Agric. Exp. Sta., East Lansing]

The respiration rate of paired samples of sugar-beet roots was measured before and after irradiation of half of each pair with 50, 100, 300, 750 or 3000 thousand rep high-energy electrons. The 2 lowest dosages markedly increased the rate of respiration, but caused no apparent injury to the root tissues. The 2 highest dosages killed some of the surface tissues within 24 hr. and encouraged the growth of moulds.—R.B.

1271 Stout, M. **Some effects of gibberellic acid on the physiology of sugar beets.** *J. Amer. Soc. Sug. Beet Technol.* 1959, **10**, No. 4, 305–10, bibl. 6, illus. [Agric. Res. Serv. USDA]

The bolting-resistant var. NB1 was sown in a glasshouse in autumn 1956 and the plants were transferred to continuous illumination on 14 Jan. 1957. The growing points were treated weekly with 0, 10, 25, 50 or 100 μg GA until 11 March and subsequently with 10 times as much GA. All plants except one had bolted by 15 April and most of the stems were semi-vegetative. In a similar test with 10 plants given 500 ppm. GA weekly from 22 April, all bolted by 10 June, but only 1 plant produced a normal inflorescence. All control plants remained vegetative. GA at 0, 5, 10, 50, 100, 500, 1000 and 2000 ppm. was applied on 26 Feb. and subsequently at weekly intervals to growing points of 2 dwarf-mutant sugar-beet varieties. By 10 April, plants receiving more than 50 ppm. GA had produced normal inflorescences many times the height of those typical of the varieties used. Field-grown sugar beet of 4 varieties whose growing points were treated with 1 mg GA on 30 Aug., 5 Sept. and 24 Sept. 1956 contained a lower percentage of sugar at harvest and had a lower root respiration rate than untreated beets. GA applied as a foliar spray had little effect on the percentage dry matter, N content or respiration rate of leaf discs cut within 1 week of treatment.—R.B.

1272 Wheatley, G. W. and Johnson, R. T. **Studies on the use of gibberellic acid to induce flowering in sugar beets.** *J. Amer. Soc. Sug. Beet Technol.* 1959, **10**, No. 4, 335–43, bibl. 2, illus. [Spreckels Sugar Co., Spreckels, California]

Sugar-beet seedlings and stecklings were sprayed to runoff with 100, 500 or 1000 ppm. GA ; or lanolin paste containing 0·1% GA was applied to the growing points. GA did not improve seed production where the plants were sufficiently vernalized, but increased the percentage of flowering and seed set where the plants were insufficiently vernalized. Biennial varieties treated with GA did not behave as annuals. Roots from seed-production plots which failed to bolt after overwintering, flowered and set seed when removed to a glasshouse and treated with three 1000 ppm. GA sprays at 10-day intervals, or with 0·1% GA in lanolin paste.—R.B.

1273† Lewicki, S. and Mysakowska-Paleolog, Barbara. Dóswiadczenia z " produkcyjną " jarowizacją buraków cukrowych i pastewnych. **Experiments on " productive " vernalization of sugar and forage beets.** *Ann. Univ. M. Curie-Skołdowska* 1957 Sect. E, 1959, **12**, 361–77, bibl. 3, English summary.

Under conditions of this test, vernalization of beet seeds at +3°C. for 3 days gives greater root yields than vernalizing at +6°C. for 12 days. The treatment has no distinct effect on the leaf yields nor on the absolute content of dry matter or sugar in the roots ; the increase in yields of dry matter or of sugar per surface unit [ha] is an expression only of the greater root mass resulting from vernalization. Seed soaking [prior to vernalization] results in a higher root yield (than that of vernalized dry seed) when soil moisture is deficient at sowing time. F. Eng.s.—M.H.

1274 Lefèvre, G. and Hiroux, G. Essai sur l'influence de la date d'apport des engrais azotés sur le rendement de betteraves sucrières. Développement végétatif et marche de l'absorption d'azote. [**Trial to study the influence of the date of applying N fertilizers on the yield of sugar-beet. Vegetative development and the course of N absorption.**] *Ann. agron., Paris* 1959, **10**, No. 4, 477–92, bibl. 4, English, German and Russian summaries. [Sta. Agron., Amiens, France]

Although results from the field trials described showed no marked differences from applying N fertilizers at different dates, the following observations were made on the vegetative development of sugar-beet : (a) at 70 days after sowing, the plants started active growth and this coincided with a marked increase in temperature ; the date of sowing should, therefore, be chosen so that 70 days later the average temperature is above 16°C. ; (b) leaf growth ceased when the amount of dry matter in the leaves was about equal to that in the roots, this amount being then a little more than half the final root yield.—E.B.O.

1275 McQueen, G. R. **Effect of applied nutrients on the chemical composition of soil and on sugar beets.** *Quart. Bull. Mich. agric. Exp. Sta.* 1959, **42**, No. 1, 74–85, bibl. 5.

Fertilizer treatments applied to sugar-beet were : 2208, 3680 or 5520 lb. triple superphosphate/ac., 1785, 3675 or 4725 lb. KCl/ac., 0, 750 or 1500 lb. NH_4NO_3 /ac. Both levels of N significantly increased root yields, but reduced sucrose percentage and gross sugar content. Applications of P had no effect on yield or sugar content. Applications of K decreased gross sugar yield per ac. where N was applied. At the lowest N level, K decreased root yield. The nitrate content of the plant tissue was very high where N had been applied. The level of P applied did not affect the P content of the petioles, but where N was applied, the P content was lower in tissue where nitrate was present than where it was absent. On soil low in P, applications of P to the soil increased the P concentration in the tissues, and applications of N decreased the P concentration. Foliar sprays of P tended to increase the concentration of P in the tissues in proportion to the amount applied and possibly influenced the yield of roots and sucrose percentage. Soil penetrometer data indicated that the soil was least compacted in those fields which produced highest yields of roots.—A.M.H.

1276 Adams, S. N. **Present views on sugar beet manuring.** *Brit. Sug. Beet Rev.* 1959, **27**, No. 3, 111–13. [Rothamsted Fld Sta., Dunholme, Lincoln]

A summary of recommendations is given.—E.B.O.

1277 Commissie ter Bevordering der Suikerbietenteelt in de Noordelijke Provinciën. Een stikstofproef op gescheurd klaverland. [**A nitrogen trial on ploughed-in clover.**] *Meded. Inst. rat. Suikerprod.* 1959, **29**, No. 3, 78–9, illus.

Hilleshög standard polyploid sugar-beet given 0, 40, 80, 120 or 160 kg. N/ha was grown following a 1-yr. crop of white clover used as pasture. Yields of tops and roots increased with increasing levels of applied N, but the highest percentage sugar (15·3%) and highest sugar yields (62·9 kg/are) were obtained from unmanured beets.—R.B.

FODDER-BEET

1278† Statens Forsøgsvirksomhed i Plantekultur, Denmark. Forsøg med stammer of foderbeder 1956–59. [**Varietal trials with fodder-beet 1956–9**] *Medd. 636 Stat. Forsøgsvirk. Plantekult.* 1960, pp. 4.

The results are given of trials at 11 locations in Denmark with 3 Barres mangel, 10 fodder-beet and 2 sugar-beet-for-fodder varieties. Two mangel varieties, Pajbjerg Ideal P (polyploid) and Øtofte Nova were officially approved (and given the Roman numeral XII). Their mean yields were 138·7 and 137·8 hkg/ha dry matter in the roots + 60% of the tops and the dry matter content of their roots averaged 15·3 and 16·1%, respectively. Nine fodder-beet varieties were officially approved. Of these, the highest mean yields of dry matter in the roots + 60% of the tops were given by Pajbjerg Korsroe P (polyploid), Gul Øtofte, Hunsballe Alba, Hvid Øtofte and Hvid Gimsing, with 140·5, 141·6, 140·8, 140·4 and 137·7 hkg/ha, with dry matter contents in the roots of 16·3, 19·3, 18·1, 19·9 and 15·8%, respectively. Both the sugar-beet-for-fodder varieties Hinderupgaard and Hunsballe Kora were officially approved. The mean yields of dry matter in their roots + 60% of the tops were 142·4 and 141·3 hkg/ha, with dry-matter contents in the roots of 20·7 and 21·1%, respectively. Data are given of the yields of tops and there are brief descriptive notes on each variety.—P.J.B.

1279 Masterson, C. **The effect of sodium and potassium on fodder beet.** *J. Dep. Agric. Republ. Ire.* 1957–8, **54**, 187–97, bibl. 21.

Literature on the effects of Na and K on various crops is reviewed. Field experiments were laid down at 40 centres in 1952 and 49 centres in 1953 to determine the response of Hunsballe fodder-beet to Na and K in the presence or absence of farmyard manure. Treatments were 0 or 15 tons f.y.m./ac. ; 0, 2 or 4 cwt. muriate of potash/ac. ; 0, 2 or 4 cwt. agricultural NaCl/ac. All treatments gave significant yield increases over the controls. Without f.y.m., the yield increases due to

K was more than twice that due to Na. In each case increasing the dressing from 2 to 4 cwt. gave only a relatively small yield increase. Where Na and K were applied together, the yield increase per cwt. muriate of potash was 3–4 times that per cwt. of NaCl. The response to Na and K was greatly reduced in the presence of f.y.m. Dressings of 4 cwt. of each fertilizer gave an increase of 2·5 tons roots/ac. in the presence of f.y.m., compared with 5·5 tons/ac. without f.y.m.—A.M.H.

POTATOES

1280 Parks, N. M. **Potato growing in Canada.** *Publ. 918 [Revised] Exp. Fms Serv. Canada Dep. Agric.* 1958, pp. 29, illus.

The growing of potatoes in Canada is described under the following heads : crop rotations, green manuring, fertilizers, tuber disinfection, cutting of setts, varietal recommendations, planting, cultivation, irrigation, insect and disease control, haulm-killing, harvesting and inhibition of sprouting.—R.B.

1281 Félix, A. Trabajos de experimentación en el cultivo de la papa. [**Trials in growing potatoes.**] *Bol. trim. Exp. agropec., Lima* 1959, **8**, No. 2, 26–8. [Esta. Exp. Agropec., Junín, Peru]

In the Sierra Central of Peru, potatoes are grown either in the regions above 3600 m alt. under natural rainfall where seed potatoes of more than 70 g each are planted, or in the Andine valleys under irrigation. In a trial in the Mantaro valley at 3200–3300 m alt., seed potatoes of various sizes were planted, at different spacings in furrows 1 m apart. Results showed no significant differences in yield between the following best treatments : 25 g at 25 cm ; 50 g at 25 cm ; 25 g at 15 cm ; 50 g at 30 cm ; and 75 g at 45 cm.—E.B.O.

1282 Montague, V. J. and others. **Potato production.** *Bull. Potato Tech. Comm. Dep. Res. Spec. Serv.* [Cont. in] *Rhod. agric. J.* 1960, **57**, No. 1, 52–68, illus.

Basic information is given on the cultivation of potatoes in Rhodesia. An appendix gives recommendations for varieties and fungicides. F. s.—S.M.J.

1283 Majmudar, V. F. **Deesa potato.** *Farmer, Bombay* 1959, **10**, No. 8, 9–11, illus.

In the Deesa area, potato is a winter crop, and since it is grown in sandy river beds by the intensive method, yields (5 tons per acre) are higher than in other parts of Bombay State. An account is given of tillage, control of water in channels, manuring, planting of setts, harvesting, yield and storage.—D.B.

1284 Brown, P. H. and Broadbent, L. **Seed potatoes from your own farm.** *Agriculture, Lond.* 1960, **66**, No. 11, 506–8.

Work at Efford and Rothamsted Experimental Stations has shown that seed potatoes can be satisfactorily produced in S. England, provided that virus-infected plants are removed and spraying with DDT is carried out to prevent the spread of leaf-roll virus and virus Y.—S.M.J.

1285 Fabiani, L. La coltura della patata da semina in Svizzera. [**The growing of seed potatoes in Switzerland.**] *Sementi elette* 1959, **5**, No. 6, 36–40; bibl. 2, illus., English and German summaries.

1286 Kawakami, K. and others. **Studies on the improvement of potato culture by using seed tubers of suitable age. 1. Relation between age and productivity of seed tubers in the spring culture.** [Japanese] *Proc. Crop Sci. Soc. Japan* 1959, **28**, No. 1, 138–9, bibl. 5, illus., English summary. [Hyogo Agric. Coll.]

Judging by the yield of tubers of over 100 g, summer-grown seed tubers (Irish Cobbler) are in the best physiological condition for spring cultivation when 6 months old, autumn-grown tubers (Ojiro and Unzen) when 3–4 months old. F. Eng. s.—D.B.

1287 Kawakami, K. and Takayama, A. **Studies on the improvement of potato culture by using seed tubers of suitable age. 2. Relation between age and productivity of seed tubers in the fall culture.** [Japanese] *Proc. Crop Sci. Soc. Japan* 1959, **28**, No. 1, 140–1, bibl. 4, illus., English summary. [Hyogo Agric. Coll.]

Judging by the total yield of tubers of over 23 g, the early spring-grown seed tubers of Wheeler and Norin No. 1 are at a suitable physiological stage for autumn cultivation when 3 months old and the spring-grown tubers of Ojiro and Unzen when 2·5 months old. F. Eng. s.—D.B.

1288 Taylor, C. E. and McDermott, Nora. **The influence of pre-planting treatment of tubers on the growth and yield of two varieties of potato.** *Europ. Potato J.* 1959, **2**, No. 4, 272–7, bibl. 1, French and German summaries. [Univ. Nottingham Sch. Agric., Sutton Bonington]

Seed potatoes, var. Arran Pilot and Ulster Chieftain, were (a) desprouted except for a single apical sprout, or tubers with a single apical sprout were selected, (b) completely desprouted, or (c) untreated, bearing 3–4 apical sprouts, and were planted on 12 April, and harvested on 21 June, 4 July and 23 July (Arran Pilot), or 21 June, 9

July and 25 July (Ulster Chieftain). Tubers from group (c) produced haulms with a greater number of stems above ground than did those of the other 2 groups. The number of main stems produced below ground was significantly greater for tubers from group (c) than for those from groups (a) or (b) in Ulster Chieftain but not in Arran Pilot. There was no significant difference between tubers from groups (a) and (b) in the number of stems produced. The number of shoots produced per tuber was greatest for group (c) in Arran Pilot and for group (b) in Ulster Chieftain. At the first 2 lifting dates, tubers of Arran Pilot from group (a) and tubers of Ulster Chieftain from group (c) yielded better than other groups. In Arran Pilot, group (a) yielded a greater number and weight of ware tubers than other groups at the latest date of lifting. In Ulster Chieftain, group (b) produced least ware size tubers. Differences in total yields (number and weight of tubers) at the final lifting were not significant.—R.B.

1289 WINTER, E. J. **The irrigation of potatoes.** *Agriculture, Lond.* 1960, **66**, No. 12, 549–51, bibl. 3. [National Vegetable Research Station, Wellesbourne]

In 1959, irrigating early potatoes with a total of 5 in. water applied throughout the growing season whenever the soil moisture deficit reached 0·75 in., resulted in an increased yield of 54% over unirrigated plots. The application of 1·8 in. water in 2 irrigations at the tuber-formation stage resulted in a 30% increase in yield. In a dry season, irrigation may be necessary before a soil moisture deficit of 0·75 in. is reached, but irrigation at tuber formation (which approx. coincides with flowering) is the most profitable. Overhead irrigation of early potatoes helps to reduce frost damage during the 4 days following watering.—S.M.J.

1290 HOPE, G. W. and others. **The effect of harvest date and rate of nitrogen fertilization on the maturity, yield and chipping quality of potatoes.** *Amer. Potato J.* 1960, **37**, No. 1, 28–33, bibl. 22. [Can. Dep. Agric., Kentville, Nova Scotia]

Kennebec and Sebago potatoes were grown in 1956 and '57 with 0, 80, 160, 240 (1957 only) or 320 (1956 only) lb. N/ac. and 240 lb. of both P_2O_5 and K_2O/ac. and harvested at 10-day intervals from mid-Aug. to mid-Oct. to determine the effect of N and date of harvest on the lightness in colour of potato crisps made from the tubers. Highest yields were obtained from plots given 160 lb. N/ac. and harvested when at least 80% of the leaves had died ; these tubers made satisfactory crisps. Tubers harvested at maturity produced lighter-coloured crisps than those harvested earlier. Immature tubers tended to contain more reducing sugars. Darker crisps were produced where potatoes were grown with more than 80 lb. N/ac. Kennebec produced satisfactory crisps at all dates of harvesting and all levels of N, and matured earlier and gave higher yields than Sebago.—R.B.

1291 PETERSON, C. E. and HOOKER, W. J. **Tawa : a new early potato variety resistant to late blight, scab, and immune to latent mosaic.** *Amer. Potato J.* 1959, **36**, No. 8, 267–74, bibl. 7, illus. [Michigan Agric. Exp. Sta., East Lansing]

The early potato variety Tawa has white elliptical tubers and is resistant to virus A, *Streptomyces scabies* and to at least 2 races of *Phytophthora infestans*, and is immune to virus X. Tawa is recommended for areas where Cobbler or other early potatoes do not yield well because of scab or blight.—R.B.

1292 ISLEIB, D. R. and WHEELER, E. J. **Evaluation of potato varieties and seedlings in Michigan, 1955-58.** *Quart. Bull. Mich. agric. Exp. Sta.* 1959, **42**, No. 1, 146–53, bibl. 3.

Data are given on the yield and culinary quality of 30 potato varieties tested in Michigan in 1955–8.—A.M.H.

1293 KLAPP, E. Nachprüfung des deutschen Kartoffel-Sortiments 1939 bis 1958. [**Testing of the German potato varieties from 1939–58.**] *Z. Acker- u. PflBau* 1959, **109**, No. 2, 121–26, bibl. 2. [Inst. PflBau, Univ. Bonn, W. Germany]

1294 HOLMES, E. **A new quaternary ammonium herbicide.** *Proc. Afr. Weed Contr. Conf., S. Rhodesia, July, 1958* [n.d.] 132–4.

Effective destruction of early-potato haulms under humid conditions was obtained by applying 1 : 1'ethylene 2 : 2' dipyridylium dibromide at 1 or 2 lb./ac. or at 0·5 lb. + wetter/ac. Satisfactory destruction of maincrop potato haulms and pre-harvest control of weeds was obtained by applying the herbicide at 2 lb./ac. Up to 1 lb. of the herbicide + wetter/ac. resulted in good pre-harvest desiccation of leguminous forage crops for seed. Low-volume applications of 5–10 lb./ac. killed the foliage of *Rubus* sp., *Rosa* sp., *Crataegus* sp., *Sambucus* sp. and *Ulmus* sp.—S.M.J.

1295 CHOUDHURI, H. C. and PAL, S. C. **Forecasting late blight of potatoes in the hills of West Bengal.** *Amer. Potato J.* 1959, **36**, No. 8, 284–7, bibl. 7, illus. [Agric. Dep. Govt. W. Bengal, Calcutta, India]

The forecasting of attacks of late blight (*Phytophthora infestans*) in West Bengal by the use of the moving graph method based on rainfall and temperature data [*Fld Crop Abstr.* 9 : 505] was

investigated, using climatological and infestation data for 1952–8. Forecasting was more accurate when based on 7-day periods during which rainfall exceeded the 7-day average total rainfall (1.82 in., calculated), than where based on 10-day periods of above-average rainfall.—R.B.

1296 Erickson, H. T. **Potato scab control on organic soils. 1. Initial response to PCNB.** *Amer. Potato J.* 1960, **37**, No. 1, 18–22, bibl. 6. [Purdue Univ. Agric. Exp. Sta., Lafayette, Indiana]

Soil heavily infected with *Streptomyces scabies* was treated in 1956 with PCNB at 0, 100, 200 or 300 lb./ac. and planted the following day with Katahdin potatoes. In 1957, half of each plot was given the same treatment as in 1956, with the exception of the control plots, of which half of each was given 200 lb. PCNB/ac. The treatments had no significant effect on tuber yield or sp. gr. The percentage of tubers free from scab was increased by all PCNB treatments, and their residual effect during the year following treatment was appreciable. Plots treated with 300 lb. PCNB/ac. in 1956 yielded 55% disease-free tubers in 1956 and 60·5% disease-free tubers in 1957, while plots treated in both years yielded 85% disease-free tubers. Untreated plots produced 9 and 28·5% disease-free tubers in 1956 and '57 respectively.—R.B.

1297 Labruyère, R. E. De invloed van knolontsmetting en grondontsmetting op het optreden van de Rhizoctoniaziekte en de schurftziekte bij aardappelen in 1958. [**Influence of tuber- and soil-disinfection on the occurrence of *Rhizoctonia* and scab in potatoes in 1958.**] *Gestenc. Versl. Proefst. Akker. Weidebouw, Wageningen* 1959, No. 64, pp. 29, mimeo.

An account is given of experiments at 6 locations with tubers uninfected, slightly or heavily infected with *Rhizoctonia solani* or *Streptomyces scabies* disinfected for 0, 1, 5 or 15 min. with one of 5 preparations and planted in untreated soil or soil treated with PCNB. The results indicated the value of regular disinfection, especially in the production of seed potatoes, even in years with little incidence of *Rhizoctonia*. Disinfection times should be adjusted according to the degree of infection of the seed tubers. PCNB used for soil disinfection should not be combined with heavy disinfection of tubers. In sandy soils, infection from the soil is often more serious than in clay districts. PCNB is effective for suppressing *Rhizoctonia* and scab in sandy as well as other soils, but it causes off-flavours and means for preventing this require investigation.—G.M.R.

1298 Lowings, P. H. and Ridgman, W. J. **A spot-sampling method for the estimation of common scab on potato tubers.** *Pl. Path.* 1959, **8**, No. 4, 125–6, bibl. 5.

A plastic strip, marked at regular intervals, was looped round the longitudinal axis of the tuber and the number of gradations coinciding with scab (*Streptomyces scabies*) lesions was expressed as a percentage of the total number of gradations round the long axis of the tubers.—S.M.J.

1299 Guthrie, J. W. **The influence of seed-piece treatment on disease control and yield of Russet Burbank potatoes.** *Amer. Potato J.* 1959, **36**, No. 9, 309–14, bibl. 10. [Idaho Agric. Exp. Sta., Moscow]

Cut setts of Russet Burbank potatoes were treated 1 or 10 days before planting by dipping in aqueous solutions of (a) agrimycin (15% streptomycin + 1·5% oxytetracycline) at 26 g/10 U.S. gal., and/or (b) phygon at 453 g/10 gal., (c) semesan bel (12·5% hydroxymercurinitrophenol + 3·8% hydroxymercurichlorophenol) at 648 g/10 gal., (d) 75% captan at 181g/10 gal., or (e) terraclor 75 (75% PCNB) at 453 g/10 gal. None of the treatments had any significant effect on yields of tubers grown under irrigation. Where grown without irrigation, treatments (c) and (a + c) applied 1 or 10 days before planting and treatments (b), (d), (a + b) and (a + d) applied 1 day before planting, significantly increased total tuber yields, while treatments (a) and (a + e) applied 1 day before planting significantly reduced yields. Treatments (c), (e) and (a + c) reduced the incidence of *Rhizoctonia solani* where applied 10 days before planting on irrigated plots and 1 or 10 days before planting on unirrigated plots. Decay of setts was reduced by all treatments except (a), (e) and (a + e).—R.B.

1300 Wrazidlo, W. Zur Anzucht von Augenstecklingspflanzen für die Beurteilung des Gesundheitswertes von Kartoffelpflanzgut in Kieskultur. [**The cultivation in gravel culture of plants from " eye cuttings " for assessing the healthiness of seed potatoes.**] *Z. landw. Vers.- u. UntersuchWes.* 1959, **5**, No. 1, 14–21, bibl. 19, illus., Russian and English summaries. [Inst. f. Landw. Versuchs- u. Untersuchungswesen, Jena, E. Germany]

A simplified procedure is described for carrying out the tuber-index test on samples of seed tubers. The eye cuttings are grown in watertight troughs which are filled to a height of 7–8 cm with quartz gravel consisting of particles 4–6 mm in diameter. The nutrient solution at a concentration not exceeding 0·2% is introduced before planting. The gravel is replenished with water but not nutrients. By this procedure, samples can be assessed 8 days earlier than when grown in earth in small pots. Comparisons between different experiment stations are valid because the " seed "

bed and nutrient supply are identical. The gravel can be used again after disinfection.—D.B.

1301 Hamann, U. Die Ergänzung der Augenstecklingsprüfung durch das Resoblau-Färbeverfahren. [**Supplementing the tuber-index test with the resoblue colour test.**] *Z. landw. Vers.- u. UntersuchWes.* 1959, **5**, No. 1, 22–34, bibl. 13, Russian and English summaries. [Inst. PflZücht. Gross-Lüsewitz, E. Germany]

Tests made in autumn were more reliable than those made in January. It is suggested that this test, which is the same as the Igel/Lange test, should be used in conjunction with the tuber-index test.—D.B.

1302 Neitzel, K. and Pfeffer, C. Über die Bestimmung des Krautzieh- oder Frührodetermins durch Blattlauskontrollen. **The determination of the date of haulm-pulling or early harvest by means of aphid checks.** *Europ. Potato J.* 1959, **2**, No. 3, 199–222, bibl. 42, English, French and Russian summaries. [Deutsche Akad. LandwWissensch. zu Berlin, Inst. PflZücht. Gross-Lüsewitz, E. Germany]

Potatoes of 6 varieties were grown for seed at Bernburg, E. Germany, during 1954–6. Haulm-pulling took place as soon as tubers of a size suitable for seed had been formed and at weekly intervals thereafter. Harvesting of virus-free seed potatoes was possible where haulms of non-resistant varieties were pulled 8–10, 10–12 or 14–15 days after populations of *Myzus persicae* had reached a threshold [defined] in the case of early, medium, and medium-late to late varieties, respectively, or 19–20 days after the threshold in the case of resistant late varieties, such as Aquila and Capella.—R.B.

1303 Ahmadi, A. A. and others. **The effect of time of planting on occurrence of internal brown spot in the potato variety Arran Banner in Lebanon.** *Amer. Potato J.* 1960, **37**, No. 1, 23–7, bibl. 4, illus. [Amer. Univ. Beirut, Lebanon]

Internal brown spot of potatoes, considered to be a physiological disorder, decreased in severity as planting date was delayed. Planting in Feb. produced 64–78% affected tubers, while planting in early June gave 1–5% affected tubers. Delay in date of planting improved the size, shape, quality and storage properties of the tubers, but decreased yields.—R.B.

1304 Wolcott, A. R. and Ellis, N. K. **Internal browning of potato tubers : varietal susceptibility as related to weather and cultural practices.** *Amer. Potato J.* 1959, **36**, No. 11, 394–403, bibl. 17. [Purdue Univ. Agric. Exp. Sta., Lafayette, Indiana]

Potatoes of 20 varieties were grown under recurrent drought conditions in 1953 and with a water table maintained at 18-24 in. in 1954. Internal browning injury was more severe in 1954 than in 1953. Necrotic symptoms were first observed during, or just after, periods of rising temperature or of increasing soil moisture following periods of low temperature or drought. Severe internal browning developed at the same time as extensive resorption of tubers during periods of fluctuating temperature in Sept. The distribution of internal brown spot, heart necrosis, corky ringspot (spraing) and internal rust spot among varieties and different dates of planting indicated that the different patterns of necrosis had a common physiological origin, but varied in form and severity with the stage of development of tuber tissues at the time of injury. There was a marked tendency for internal browning injury to be more extensive in late than in early varieties.—R.B.

1305 Gustafsson, N. Missfärgar blastdödningen potatisens kärlringar ? [**Does haulm-killing cause vascular ring discoloration in potatoes** ?] *Lantm. Svenskt Land* 1960, 71, No. 16, 364–5, illus. [Inst. för Växtforskning och Kyllagring, Nynäshamn, Sweden]

The possible connection between the use of chemical haulm-killers and vascular ring discoloration in potato tubers is discussed in the light of cases of this disorder which occurred in Sweden in 1959. It is concluded that the dry, hot conditions of that year were principally responsible for the disorder and that in seasons with similar weather it is not advisable to interrupt the growth of potatoes by using haulm-killers ; where they are used, they should not be applied in amounts which exceed those recommended.—P.J.B.

1306 Ochoa, C. Nuevas especies de *Solanum* (Tuberarium, subsec. Hyperbasarthrum) del Perú. [**New species of *Solanum* (Tuberarium, subsec. Hyperbasarthrum) of Peru.**] *Agronomía, Lima* 1959, **26**, No. 2, 109–13, illus.

Solanum huancabambense, *S. mochiquense* and *S. pascoense* are described.—E.B.O.

1307 Nishiyama, Y. and Tagawa, T. **On the changes of the terminal oxidase systems with special reference to the dormancy of potato tubers.** [Japanese] *Proc. Crop Sci. Soc. Japan* 1959, **28**, No. 1, 134–7, bibl. 8, English summary. [Hokkaido Univ.]

1308 Szalai, I. **Tryptophane contents of new potato tubers forced by rindite in the different phases of the germination.** *Physiol. Plant.* 1959, **12**, No. 1, 155–61, bibl. 12.

Sprouting of potato tubers was induced by treatment with 0·8 ml rindite (a 7 : 3 : 1 mixture of ethylene chlorhydrin, ethylene dichloride and carbon tetrachloride)/kg for 48 hr. Tubers were then placed in wet sand at 20–21°C. and the free

and bound tryptophane (TTP) contents determined at 1, 8, 15, 22 and 29 days after treatment. The total TTP content in the tubers increased rapidly following treatment and reached a maximum on the 15th day. At this stage most of the TTP present was in the bound form and the free TTP was mostly located at the centre of the tuber. In spontaneously sprouted tubers the required quantity of free TTP was continuously released from the bound TTP for the formation of growth substances and was directly utilized. The rate of release of bound TTP was determined by utilization.—S.M.J.

1309 Nottingham University School of Agriculture. **Factors affecting plant growth.** *Rep. Nottingham Univ. Sch. Agric. 1958.* Sutton Bonington 1959, 18–21.

Potato tubers were initiated more rapidly when days were short and nights cool (ultimately resulting in higher yields), but gained the most weight individually when days were long and nights warm. Bud growth during the sprouting of potato tubers was associated with the amount of substrate available, N being most important. Planting potatoes in depressions in the ground rather than on ridges was moderately successful.—J.D.J.

1310 Kallio, A. **A study of the effects of photoperiod on the growth and development of the potato (*Solanum tuberosum* L.) at Fairbanks, Alaska.** *Diss. Abstr.* 1959, **20**, No. 4, 1119–20. [Univ. Minnesota, Minneapolis 14]

In trials during 1953–5, Kennebec (late) and Pawnee (mid-season) potatoes were grown under (a) natural daylength ranging from 14·8 to 21·9 hr., (b) under 12 hr. daylengths from emergence to harvest or (c) 12 hr. daylengths from the time of tuber formation to harvest. Short daylengths reduced the growth of tops in both varieties, though to a greater extent in Pawnee, but had no effect on stem number, tuber initiation or flower bud formation in either variety, though flower buds on plants grown under short daylengths abscissed without opening. Tuber numbers were slightly lower in plants under treatment (c) than under treatments (a) or (b). Short daylengths reduced tuber yields of both varieties, though more so in Pawnee than Kennebec.—P.J.B.

1311 Okazawa, Y. **Studies on the occurrence of natural gibberellin and its effects on the tuber formation of potato plants.** [Japanese] *Proc. Crop Sci. Soc. Japan* 1959, **28**, No. 1, 129–33, bibl. 15, illus., English summary. [Hokkaido Univ.]

From results of various tests (enumerated) on Irish Cobbler and Norin No. 1, it was concluded that potato tissues contain some gibberellin-like compounds one of which may be regarded as a natural gibberellin. This substance was found in the various plant parts in increasing quantity in this order : leaf, middle part of stem, tuber, stem tip, sprout. A gibberellin inhibitor was also present. When gibberellin was applied to potato plants, no tubers were formed, even under short day, from which it is concluded that the naturally occurring gibberellin may have some important physiological function in controlling tuber formation in potato plants. F. Eng. s.—D.B.

1312 Scaramella Petri, Piera. **Morphological characters considered as an indication of physical age of *Solanum tuberosum* plants cultivated in different ecological localities.** *Europ. Potato J.* 1959, **2**, No. 3, 153–64, bibl. 19, illus., French and German summaries. [Univ. Bologna, Italy]

A similar paper written in Italian was published in *Genet. agr.* 1958, Vol. 9, No. 4, 328–61. [See *Fld Crop Abstr.* 12 : 794.]—R.B.

1313 Henriksen, J. B. Såringens indflydelse på kartoflers ånding. [**The respiration of wounded potatoes.**] *Tidsskr. Planteavl* 1959, **63**, No. 4, 658–66, bibl. 7. English summary.

Potato tubers, var. Bintje, which had been wounded by dropping or peeling were placed at 18°C. for the first 16 days after wounding and then at 3°C. Maximum respiration occurred 2–4 days after wounding and then decreased to the same level as that of undamaged potatoes. The respiration of tubers for the first days after wounding by part-peeling was 2·5 times that of unwounded tubers. Respiration of tubers wounded by dropping on to a rough surface was 8 mg O_2/kg/hr. for the first 6 days and then decreased to 1 mg/kg/hr. for the following 2 months, compared with an initial respiration rate of 6 mg/kg/hr. which fell to 1·5 mg/kg/hr., for undamaged tubers.—S.M.J.

1314 Murphy, H. J. and Goven, M. J. **Factors affecting the specific gravity of the white potato in Maine.** *Bull. 583 Maine agric. Exp. Sta.* 1959, pp. 24, illus.

The effects of date of planting, length of growing season, date of harvest, rates of N and K applied, varietal characteristics, date and method of haulm destruction, temperature, soil moisture and rainfall, photoperiod, light intensity, storage and the use of sprout inhibitors on the specific gravity of potatoes are discussed.—R.B.

1315 Pfeffer, C. Über den Einfluss der Düngung auf den Pflanzgutwert von Kartoffeln. **The effect of fertilization on the seed value of potatoes.** *Europ. Potato J.* 1959, **2**, No. 4, 238–50, bibl. 9, English, French and Russian summaries.

[Deutsche Akad. LandwWissensch. zu Berlin, Inst. PflZücht. Gross – Lüsewitz, E. Germany]

Potatoes, var. Mittelfrühe, Ackersegen and Capella were grown (1st generation) in loess or sandy soil receiving (a) 40 kg N, 36 kg P_2O_5 and 80 kg K_2O/ha, with or without B, Cl, Cu or Mn, (b) 80 kg N, 72 kg P_2O_5 and 160 kg K_2O/ha, (c) 100 kg N, 36 kg P_2O_5 and 80 kg K_2O/ha, (d) no inorganic fertilizer. Tubers harvested from these plots were stored under uniform conditions and used as seed the following year. Those harvested from treatments (b) and (c) on sandy soil sprouted earlier than those from other treatments. Second-generation plants from tubers from treatments (b) and (c) showed more vigorous haulm growth, and where the 1st generation was grown in poor soil, gave higher yields than those from treatments (a) and (d).—R.B.

1316 Kartoffelbau. **Manuring of potatoes.** *Kartoffelbau* 1960, **11**, No. 1.

This issue of *Kartoffelbau* includes the following papers : Manuring in potato cultivation, by F. Schmitz ; Green manuring of the potato crop by undersowing, by E. Lütke-Entrup ; Effect of different combinations of fertilizers on the simplification of work and on yield and quality of the crop, by B. Arenz, A. Grassmann, L. Kiessling ; Phosphate manuring in potato cultivation, by S. Gericke ; Trace-element manuring (Mg, B, Mn, Cu) in potato cultivation, by W. Werner ; Manuring of potatoes on light soils, by W. Meyer-Bahlburg.—D.B.

1317 Simpson, K. **Effect of supplementing rainfall on the uptake of phosphorus from superphosphate by potatoes.** *J. Sci. Fd Agric.* 1960, **11**, No. 2, 71–9, bibl. 23.

Superphosphate was applied to potatoes at 0, 0·25, 0·5, 1 and 2 cwt. P_2O_5/ac. with or without irrigation. Irrigated plots received a total of 4 in. water from May to Aug. Application of superphosphate delayed emergence of the potato plants. The P content of the shoots and roots increased in the early stages of growth under irrigation. Compared with non-irrigated crops, irrigation doubled the uptake of fertiliser P at the 6-week stage of growth. Uptake of soil P was depressed by the addition of superphosphate. Irrigation increased total-P uptake at all sampling dates and after 12 weeks, total-P uptake approached 30 lb. P_2O_5/ac. where the 2 cwt./ac. rate was used.—S.M.J.

1318 Timm, H. and others. **Potato quality lowered in field tests with high nitrogen fertilization.** *Calif. Agric.* 1960, **14**, No. 1, 13.

Potatoes, var. White Rose and Kennebec, were grown for 104–110 days with 60, 120, 180 or 240 lb. N/ac. and 0, 60 or 120 lb. superphosphate/ac. Increasing N applications increased the total yield of tubers, but significantly decreased their dry-matter content. Yields of No. 1 ware tubers were decreased where more than 120 lb. N/ac. were applied. The percentage of rotted tubers in Kennebec increased with increasing N applications. Total tuber yields were increased by P to a greater extent than those of ware tubers.—R.B.

1319 Steineck, O. Der Ertragsaufbau der Kartoffel. [**The yield structure of potatoes.**] *Bodenkultur* 1959, **10**, No. 3, 231–45, bibl. 20. [Inst. PflBau u. PflZücht., Hochschule für Bodenkultur, Wien, Austria]

The yield components of 12 varieties of potato were studied. For individual plants, the yield components are number of stolons per plant, number of tubers per stolon, and average weight of tubers on a plant. The relative importance of each component is determined by varietal character, number of stolons per plant being a particularly marked one. The relationships between these components are stated. The yield components of the field crop are yield per individual plant and number of plants per unit area. In the variety Sieglinde, adequately supplied with nutrients and moisture, an increase in the number of plants from 50,000 to 66,700 per ha resulted in an increase in tuber yield from 22,200 to 29,000 kg/ha. A reliable forecast of the yield can be made by determining the yields of a few plants. In calculating crop yield the number of plants per unit area is reduced by 20% to allow for blanks and diseased plants.—D.B.

1320 Schoenemann, J. A. **Effect of variety and harvest date on economic returns for potato farms in central Wisconsin.** *Diss. Abstr.* 1960, **20**, No. 3, 822. [Univ. Wisconsin, Madison]

1321 Görlitz, H. Die Verwendung von Perlonnetzäcken bei der Überwinterung kleiner Kartoffelpartien. [**The use of perlon net sacks for overwintering small quantities of potatoes.**] *Z. landw. Vers.- u. UntersuchWes.* 1959, **5**, No. 1, 35–42, bibl. 3, illus., English and Russian summaries. [Inst. f. Landw. Versuchs- u. Untersuchungswesen der DAL, Potsdam, E. Germany]

Perlon was chosen because it is undamaged by moisture. Each sack holds about 50 kg of potatoes. The filled sacks are piled in pyramidal form before being covered with earth or straw or stored in cellars.—D.B.

1322 Gómez, Z. M. E. Influencia del cloro. IPC en la papa almacenada. [**Effect of chlorine IPC on stored potatoes.**] *Agric. trop., Bogotá* 1959, **15**, No. 8, 545–7.

In a trial at Tunja, Colombia, potato tubers of the varieties Tuquerreña and Tocana were treated on 8 Oct. 1957, before storage, with the

sprout inhibitor chlorine IPC, 48% active ingredient, at a rate of 100 and 200 g in 2 l of water per 1000 kg of tubers, respectively. After 6 months' storage it was found that treatment had inhibited sprouting in Tuquerreña, and had reduced it considerably in Tocana, in comparison with the untreated tubers of both varieties which had sprouts more than 5, and more than 10 cm long, respectively.—E.B.O.

1323 Burton, W. G. and de Jong, W. H. **The irradiation of ware potatoes.** *Internat. J. Appl. Rad. Isot.* 1959, **6**, 167–70, bibl. 7.

This is a review article.—R.B.

1324 Bonvicini, M. Produzione italiana di patate da seme qualificate. [**Production of certified seed potatoes in Italy.**] *Paper presented to the 1° Conv. Naz. Sementi Elette, Lonigo, Italy, 1959*, pp. 17. [Ist. Allev. Veg., Bologna]

Information is given on the present regulations, and on a proposed new law, concerning the production of certified seed potatoes in Italy.—E.B.O.

SWEET-POTATOES

1325 Izawa, G. and Okamoto, S. **Effect of mineral nutrition on contents of organic constituents in sweet potato plants during growth.** *Soil and Pl. Fd* 1959, **4**, No. 4, 163–70, bibl. 10. [Hyogo Univ. Agric., Sasayama, Japan]

The yields of plant parts and the content of sugar, starch, alcohol-insoluble solids and N fractions were determined in leaves, petioles, stems and tubers of *Ipomoea batatas* under various levels of N and K manuring. Sugars and N compounds attained their maxima in the shoots in late summer, after which they were translocated to the roots where they accumulated. K produced a slight and N a marked increase in the content of these constitutents.—D.B.

1326 Zanzibar Protectorate. [**Sweet-potato manurial and spacing trials.**] *Suppl. Ann. Rep. Dep. Agric., Zanzibar Protect, 1958* 1960, 8–9.

In Zanzibar, the application of 5 ton farmyard manure/ac. to sweet-potatoes (*Ipomoea batatas*) which were planted in mid-June and harvested in mid-Nov. resulted in a greater increase in yield than did applications of N, P or K. In a separate experiment, the application of 10 ton f.y.m./ac. to sweet-potatoes resulted in a yield of 75 cwt. fresh roots/ac. compared with 22 cwt./ac. from unmanured plots. In a spacing trial at Kizimbani the highest yield of fresh roots (7·41 ton/ac.) was obtained by planting 2 ft. apart on ridges 3 ft. apart. —S.M.J.

1327 Senn, T. L. **Storage behaviour of the sweet potato (*Ipomoea batatas* Lam.) as influenced by modified atmospheres.** *Diss. Abstr.* 1959, **20**, No. 1, 7. [Univ. Maryland]

The results are given of experiments in which, after curing, sweet-potato roots were stored in atmospheres containing different concentrations of O_2, CO_2 or N. In no case was the composition or organoleptic quality of the roots favourably affected by the treatments.—P.J.B.

1328 World Crops. **Storing sweet potatoes.** *World Crops* 1960, **12**, No. 2, 73.

Storage of sweet-potatoes for periods up to 4 months has been successfully carried out in Barbados in shallow pits, 3–4 in. deep × 3 ft. wide, which were lined with dried grass, weed cuttings and dried coconut fronds. Dry, undamaged potatoes were then stacked on this trash to a height of 3 ft. before being covered with another layer of trash, 1 ft. of soil and a final layer of trash to prevent rain wash.—S.M.J.

CASSAVA

1329 Brandão, S. S. Ensaio sôbre sistemas de plantio da mandioca. [**Trial of methods for planting cassava.**] *Rev. Ceres, Minas Gerais* 1959, **11**, No. 61, 1–7, bibl. 7, illus., English summary.

In a trial on heavy soil at Viçosa, Minas Gerais, Brazil, 2 methods of planting cassava var. Chitinha were compared : (a) cuttings 40 cm long planted vertically by thrusting 10 cm of their basal portion into the soil ; (b) cuttings 20 cm long planted horizontally at a depth of 10 cm and covered with earth (usual method). In comparison with (b), method (a) resulted in the roots penetrating about 5 cm deeper into the soil, and increased root yields by about 30% ; harvesting was easier in (b) than in (a). [See also *Fld Crop Abstr.* 12 : 813.]—E.B.O.

YAMS

1330 Sawada, E. and others. **Studies on the cultivation of Chinese yam. 4. Experiments on the planting time and pre-sprouting treatment of seed pieces.** [Japanese] *J. Hort. Assoc. Japan* 1959, **28**, No. 2, 123–9, bibl. 2, illus., English summary.

In Hokkaido, the highest yields of the Chinese yam [*Dioscorea opposita* Thunb. (*D. batatas* Decne)] were obtained from cuttings of the tubers planted early in May, the cuttings having been previously allowed to germinate, in a warm seed bed, to the stage when the adventitious bud appeared as a small knob. F. Eng. s.—D.B.

1331 Izawa G. and Natake, M. **Studies on nitrogen metabolism in Chinese yam plant (*Dioscorea batatas* Decne). 1. Changes in the content of nitrogenous constituents during the germination period.** [Japanese] *Sci. Rep. Hyogo Univ. Agric.* 1958, **3**, No. 2, 79–82, bibl. 5, English summary.

After germination there was rapid translocation of low-molecular N compounds and carbohydrates from the parent tuber to the shoot. NO_3-N reached its maximum in the shoot late in June about a month after germination. This indicated marked activity of the young root and the need for N fertilizer about this time. F. Eng. s.—D.B.

1332 Izawa, G. and Natake, M. **Studies on nitrogen metabolism in Chinese yam plant. 2. Changes in the content of nitrogenous constituents through the whole developmental stage.** [Japanese] *Sci. Rep. Hyogo Univ. Agric.* 1958, **3**, No. 2, 83–91, bibl. 9, English summary.

The metabolism, accumulation and translocation of the various N fractions in *Dioscorea batatas* was studied in the several orders of leaves and stems and in daughter tubers during the whole period of development. F. Eng. s.—D.B.

FIBRE CROPS

COTTON

1333 Collazos, R. I. Cultivo del algodón en Colombia. [**Cotton-growing in Colombia.**] *Bol. ext. 2 Inst. Fom. algodon. Bogotá, Colombia* 1959, pp. 52, bibl. 20, illus.

1334 Tanganyika Agricultural Corporation. **Rufiji Basin Survey Scheme. Trial farms.** [**Cotton**] *Rep. Tanganyika agric. Corp. 1957–8*, 83–4, 87 and 93. [Received Jan. 1960]

At Beta and Lumemo, sowing cotton in Feb. gave higher yields than later sowings. At Rujewa, the yields from Nov., Dec., Jan., and Feb. sowings were 2785, 1790, 2140 and 2920 lb./ac., respectively.—A.M.H.

1335 Llavería, B. M. El trasplante del algodonero. [**Transplanting cotton.**] *Agronomía, Lima* 1959, **26**, No. 2, 103–8. [Esta. Exp. Agríc., La Molina, Peru]

Information is given on transplanting cotton, a practice new to Peru, which has many advantages over direct sowing. Its main disadvantage is the amount of labour required. The plants are transplanted when in the middle of their vegetative period.—E.B.O.

1336 Department of Agriculture, British Guiana. [**Cotton.**] *Rep. Dir. Agric. Brit. Guiana 1958* [n.d.] 23.

Yields of 588–658 lb. seed cotton/ac. have been given by a first-ratoon crop of variety BLR 14/25 and 585 lb./ac. from a second-ratoon crop of variety BAR XLl.—J.D.J.

1337 Patrick, W. H. and others. **Response of cotton and corn to deep placement of fertilizer and deep tillage.** *Proc. Soil Sci. Soc. Amer.* 1959, **23**, No. 4, 307–10, bibl. 8, illus. [Louisiana Agric. Exp. Sta., Baton Rouge]

Cotton and maize were grown for 3 yr. at 1 location, 2 yr. at 2 locations and 1 yr. at 1 location with 500 lb. 12-12-12 (NPK) fertilizer/ac. (600 lb. at 1 location) applied : (a) 4 in. deep, (b) 14 in. deep, (c) half of the fertilizer 4 in. deep and the remainder 14 in. deep, in combination with deep (12 in.) ploughing, or subsoil tillage 14 in. deep. Yields of maize and cotton were increased by deep ploughing and by deep placement of fertilizer where precipitation was below average, especially at one location where a sharply differentiated pan was present under the plough layer. At one location where a long dry period occurred, plants on the deep-ploughed and subsoiled plots withstood the drought for a longer period than plants on plots receiving shallow tillage, but crop yields were not significantly influenced. Deep tillage encouraged root development in the subsoil.—R.B.

1338 Department of Agriculture, Cyprus. [**Cotton.**] *Rep. Dep. Agric., Cyprus 1958* 1959, p. 43.

The American upland cotton variety Coker 124 gave higher yields and longer lint than Coker 100 which is widely grown in Cyprus.—E.B.O.

1339 Foy, C. L. **Combined use of pre-emergence herbicides and cross-cultivation in cotton.** *Weeds* 1959, **7**, No. 4, 459–62, bibl. 8, illus. [Univ. Missouri, Columbia]

In trials in Missouri, CIPC was used for weed control in plots of cotton infested with crabgrass (*Digitaria sanguinalis*). Pre-emergence applications of CIPC at 6·6 lb./ac. in 40 gal. spray were made in bands 12 in. wide over cotton sown in rows 40 in. apart. The cotton plants were either thinned by cross-blocking with a disc plough 4 weeks after sowing, or hand-thinned in the normal way. Initial cotton plant-stands were approx. 50,000/ac.; after cross-blocking, stands were 9,900/ac. (well below optimum) and after hand-thinning, approx., 26,000/ac. The cotton in cross-blocked plots matured later and machine-picker efficiency was significantly lower than on the other plots. Total yields (approx. 1750 lb. seed cotton/ac.) were similar for all treatments. The results indicated that there was a cumulative advantage, in terms of

economy and weed control, in using a combination of cross-blocking and pre-emergence weed control, though a high sowing rate was necessary to offset the risk of poor plant stands and missing hills where cross-blocking was used.—P.J.B.

1340† Bingham, S. W. and Upchurch, R. P. **Some interactions between nutrient level (N, P, K, Ca) and diuron in the growth of cotton and Italian ryegrass.** *Weeds* 1959, **7**, No. 2, 167–77, bibl. 15. [N. Carolina Agric. Exp. Sta., Raleigh.]

The amount of diuron required to control weeds in cotton without injury to the crop varies according to local circumstances, and the factors which influence substituted urea herbicides are not well known. On a sandy loam (but not on a silty clay loam) cotton plants showed a vigorous growth-response to small amounts of applied P in the absence of diuron, but showed little further response to larger doses of P. In the presence of diuron, cotton growth only responded to large doses of P. The behaviour of ryegrass was similar to cotton in the absence of diuron. Where diuron was applied, successive additions of phosphorus progressively offset the effect of diuron toxicity. It is concluded that P and diuron interact and that the adverse effect of diuron on plant growth is partially regulated by the P level. N, K and pH had little influence on diuron toxicity.—J.D.J.

1341 Steyaert, R. L. Quelques données sur la physiologie de la capsule du cotonnier (en vue de l'étude de la stigmatomycose). [**Some data on the physiology of the cotton boll (with a view to the study of internal boll-rot).**] *Ann. Gembl.* 1959, **65**, No. 4, 305–32, bibl. 24. [I.N.É.A.C. Sta. Bambesa, Uélé, Belgian Congo]

This is mainly an investigation on sugars in the cotton boll in connection with the study of internal boll-rot caused by the fungi *Nematospora coryli* and *Ashbya gossypii*.—E.B.O.

1342 Last, F. T. **Effect of *Xanthomonas malvacearum* (E.F. Sm.) Dowson on cotton yields.** *Emp. Cott. Gr. Rev.* 1960, **37**, No. 2, 115–7, bibl. 8. [Gezira Research Station, Wad Medani, Sudan]

1343 Labrador, S. J. R. Principales plagas del algodón en Venezuela. [**Principal pests of cotton in Venezuela.**] *Ser. A 12 Shell, Venezuela* 1959, pp. 63, bibl. 14, illus.

Information is given on the chemical control of the following cotton pests : *Agrotis repleta, Feltia subterranea, Atta sexdens, Acromyrmex octospinosus, Systena-s-littera, Aphis gossypii, Dysdercus* spp., *Alabama argillacea, Anthonomus grandis, Sacadodes pyralis, Pectinophora gossypiella, Heliothis* spp. and *Tetranychus tumidus*.—E.B.O.

1344 Santizo, R. P. A. F. V. El picudo del algodón. [***Anthonomus grandis* on cotton.**] *Publ. Inst. agropec. nac. Guatemala* [n.d.], pp. 8, illus.

Information is given on the chemical control of *Anthonomus grandis* on cotton, the chemicals recommended being aldrin, BHC, toxaphene and dieldrin (rates and concentrations are given). It is advisable to apply an insecticide when 5% or more of the flowers or bolls are attacked by the pest.—E.B.O.

1345 Mistric, W. J., Jr. and Spyhalski, E. J. **Response of cotton and cotton pests to thimet seed-treatments.** *J. econ. Ent.* 1959, **52**, No. 5, 807–11, bibl. 9. [N. Carolina Agric. Exp. Sta., Raleigh]

Seed of Coker 100W cotton treated with thimet at 0, 0·5 or 1 lb./ac. was sown at 30 lb./ac. at 5 locations in 1955 and '56. Thimet reduced seedling emergence, but did not affect stands after thinning, and controlled *Frankliniella fusca, F. exigua, F. tritici, Thrips tabaci, Aphis gossypii, Tetranychus telarius* and *T. cinnabarinus*. The activity of *Anthonomus grandis* was reduced in plots treated with both levels of thimet, but the luxuriant foliage and delayed fruiting in treated plots favoured the development of *Heliothis zea* and *H. virescens*. Thimet significantly increased cotton yields at 2 locations where heavy insect infestations occurred early in the season and where the crop, which matured later where treated, was not damaged by adverse weather conditions or insects near the end of the growing season.—R.B.

1346 Enkerlin S., D. **Different concentrations of thiodan for the control of cotton insects.** *J. econ. Ent.* 1959, **52**, No. 6, 1068–9, bibl. 1. [Inst. Tech. Monterrey, Nuevo Leon, Mexico]

Cotton sprayed with thiodan at 0·5 or 0·3 kg/ha or with folidol at 0·7 kg/ha in 5 applications to control *Psallus seriatus, Anthonomus grandis* and *Trichoplusia ni* yielded significantly more seed cotton than untreated plots.—R.B.

1347 Department of Agriculture, Uganda. [**Control of cotton insects with DDT.**] *Rep. Dep. Agric. Uganda 1957* Entebbe, 1959, 28–9.

Plots of cotton in 5 districts were sprayed with DDT at 1 lb./ac. in 4 applications at 10–day intervals to control *Lygus* spp. Economic increases in yields of seed cotton were obtained in 4 out of 5 districts. In Acholi district, spraying increased yields by 314 lb./ac. The highest yields from sprayed cotton and the greatest increases from spraying were obtained with cotton sown in late May.—J.D.J.

1348 Proctor, J. H. [**The effect of endrin applications on certain cotton pests in**

Giar.] *Prog. Rep. Emp. Cott. Gr. Corp. 1958-9. Aden Protectorate.* 1960, 17–19.

In studies on the development of cotton as affected by insect pests at Giar, Aden, plots were untreated or sprayed with endrin emulsion (1 lb. technical endrin/ac.) at 32 gal./ac./week, with a later application at 64 gal./ac. when the plants were fully grown. Populations of *Empoasca* and *Bemisia* were reduced, while numbers of *Ferrisiana virgata* increased more rapidly on sprayed than on unsprayed cotton. The percentage of buds damaged by *Diparopsis watersi* remained low until the end of Dec., then increased more rapidly on unsprayed than sprayed cotton and approached 100% in both during March. Egg counts and light-trap records made during studies of *D. watersi* in El Kod indicated that emergence occurs before many buds are available on the cotton crop. Under conditions of heavy and sustained attack, plants were kept substantially free of *D. watersi* by 0·125% endrin spray applied to runoff at weekly intervals while unsprayed cotton crops failed.—S.M.J.

1349 ERGLE, D. R. and GUINN, G. **Phosphorus compounds of cotton embryos and their changes during germination.** *Pl. Physiol.* 1959, **34**, No. 4, 476–81, bibl. 10. [Crop Res. Div., Agric. Res. Service, USDA, and Texas Agric. Exp. Sta., College Station]

Successive changes in the amounts and concentrations of the P-containing compounds of 2 early- and 1 late-maturing varieties of cotton during a 6-day germination period were followed analytically. The dominant process of P metabolism in the germinating seed was the dephosphorylation of phytin with the simultaneous accumulation of relatively large amounts of inorganic-P. However, germination was also marked by the synthesis and accumulation of additional amounts (beyond those of the embryos) of RNA-, DNA-, protein-, ester- and lipid-P compounds. Compared with the effect of darkness, light increased the rate of phytin hydrolysis and the synthesis of lipid- and ester-P compounds during germination and early seedling growth but had no appreciable effect on the other P compounds. In the partition of P the hypocotyls plus roots of 6-day-old seedlings differed mainly from the corresponding cotyledons in that the former contained little or no phytin-P and only about one-sixth as much RNA-P. Varietal difference was limited to phytin-P which was present in the embryos and seedlings of the late variety in substantially greater amounts and concentrations than in the 2 early-maturing cottons. F. S.—D.B.

1350 ANTHONY, K. R. M. and OGBORN, J. E. A. **Water requirement of cotton in Abyan.** *Prog. Rep. Emp. Cott. Gr. Corp. 1958-9. Aden Protectorate*, 1960, 10.

Total amounts of 10 and 30 cm irrigation water were applied to a cotton crop on an initially dry soil at El Kod. Endrin was applied to half the crop for protection against bollworm (*Heliothis zea*). The yield of endrin-protected plots at the 30-cm level of irrigation was 2320 lb./ac. At the 10-cm level the yield of cotton was only 780 lb./ac. The cotton plots not receiving endrin suffered heavy losses from bollworm attack.—S.M.J.

1351 FADDA, N. R. **The use of electrical resistance units for the study of soil moisture changes and irrigation requirements in the Sudan Gezira.** *Emp. Cott. Gr. Rev.* 1960, **37**, No. 2, 118–30, bibl. 20. [Res. Div., Min. Agric., Republ. Sudan]

In comparisons of Bouyoucos conical gypsum blocks and plain or jacketed Namulonge nylon units, the plain nylon units were the most suitable for use in soil-moisture irrigation studies in Gezira clay. The irrigation of cotton when the content of available soil moisture, measured at a depth of 12 in., had dropped to 90, 70 or 50% was compared with the standard 2-weekly irrigation. The critical level of available soil moisture (ASM) was between 90 and 70%. A comparison of yields and water consumption indicated that where the crop was irrigated at 90% ASM, a saving of 35% of the volume of water consumed under standard irrigation resulted, with a yield reduction of only 5·4%. —S.M.J.

1352 VAN SCHOOR, GERMAINE H. J. Composition élémentaire du cotonnier en fonction des variations des proportions anioniques de la solution nutritive. [**Composition of cotton in relation to variations in the anion content of the nutrient solution.**] *Ann. Physiol. vég., Univ. Brux.* 1959, **4**, No. 3, 89–295, bibl. 12. [See also *Fld Crop Abstr.* 12 : 1961.]

1353 AMIN, J. V. and JOHAM, H. E. **Growth of cotton as influenced by low substrate molybdenum.** *Soil Sci.* 1960, **89**, No. 2, 101–7, bibl. 14, illus. [Texas Agric. Exp. Sta.]

Cotton plants were grown for 2 generations in nutrient solutions. Mo was supplied at 1 ppm. to one group and withheld from a second series. In the advanced fruiting stage of the first generation, chlorotic growth was observed in some of the plants grown without Mo, and in the second generation quantitative differences in growth were obtained between the 2 series. Mo deficiency was indicated by increased nitrate and reduced alcohol-soluble amino-acid content. It is suggested that the Mo content of the embryos is important from the standpoint of a critical level below which normal absorption, and possibly assimilation of this element, is greatly retarded. F. S.—E.B.O.

1354 SERRY, A. and EID, M. T. **Effect of mineral deficiency on the vegetative growth and mineral content of Ashmouni**

cotton. *Bull. 287, Min. Agric., Egypt* Cairo 1958, pp. 14, bibl. 15.

Sand culture experiments with Ashmouni cotton showed that N deficiency was associated with decreases in percentages of P_2O_5 and ash and in the quantities of Ca, Mg and K absorbed. In P-deficient cotton plants, ash, N and Ca contents were lower than in normal plants. There was an increase in percentages of P_2O_5, Ca and Mg and a decrease in ash content of K-deficient plants. In Mg-deficient plants, percentages of N, K, Ca and ash increased and that of P_2O_5 decreased.—S.M.J.

1355 SOWELL, W. F. and ROUSE, R. D. **Effect of Na on cation content of leaves and boll production of cotton plants grown in solution cultures in growth chamber.** *Soil Sci.* 1958, **86,** No. 2, 70–4, bibl. 13. [Alabama Polytech. Inst., Auburn]

Na concentration in culture solutions (9, 6 and 0 m eq./l) did not affect the content of K, Ca or Mg in leaves of cotton when the solution was held at pH 5 or 6 and aerated to contain 0–4 or 4–8 ppm. dissolved O_2. The content of Na in leaves was small when the culture solution contained adequate K, Ca and Mg and was well aerated. Where the leaves absorbed less K, Ca or Mg owing to poor aeration or shortage of these elements in the solution, more Na accumulated in the leaves. The cation content of leaves from plants grown in solutions at pH 5 and 6 was the same. Na had no effect on boll production at any level of cation ratio, pH, or root aeration used. Boll production was reduced by solutions low in K (1 m eq./l or less) or Ca (2 m eq./l). The lowest level of Mg (2 m eq./l) was adequate. All 4 cations tended to be more abundant in leaves taken from the lower parts of the plants.—J.D.J.

1356 FILIPPOV, L. A. **Concentration of cell sap in leaves as a physiological index of water supply in the cotton plant.** [Russian] *Fiziol. Rast. (Pl. Physiol., USSR)* 1959, 6, No. 1, 85–8, bibl. 2. [Ukr. Sci. Res. Inst. Irrig. Farming, Herson]

This work continues that recorded in *Fld Crop Abstr.* 11 : 290 and is concerned with an evaluation of the index from various aspects. The effect of different factors on the magnitude of the cell-sap concentration in cotton leaves has been studied, with special reference to the critical quantity, i.e. the amount which indicates the need for watering. The data (from a 3-yr study) show that sap concentration is related to : (1) soil moisture (with abundant soil moisture, the sap concentration in the leaf [4th from growing point] is not more than 11–12% but under soil drought it amounts to 20–22%) ; (2) air temperature and atmospheric moisture (there is no significant influence on sap concentration except with an acute change from normal weather, e.g. a hot, dry day results in a fluctuation of 2–3% above or below normal). The critical concentration of sap in the 4th leaf (from the growing apex) during the stage from budding to the beginning of ripening is constant. With a concentration of 12% and less, the plant is characterized by intensive growth and normal turgor of the leaves during the whole day. Maintaining this regime throughout the vegetative period may result in proliferation. An increase in sap concentration to 13 or 14% at 1–2 p.m. indicates the onset (in the daytime) of a short-term water deficit. This regime is the best for cotton growth and development, and results in good yields of high-quality cotton. The beginning of soil drought is reflected in an increase of leaf cell-sap concentation to 15–16% and is accompanied by leaf wilting in the daytime. With extreme wilting, the cell sap concentration of the leaves is raised to 20–22% or more. Crops which are subjected to prolonged water deficit may become adapted to such conditions by discarding the lower leaves and the sap concentration in the remaining leaves is raised to 18–20%. However, this does not preclude the possibility of diagnosing the need for watering by determining the cell-sap concentration.—M.H.

1357 DALE, J. E. **Some effects of the continuous removal of floral buds on the growth of the cotton plant.** *Ann. Bot., Lond.* 1959, **23,** No. 92, 636–49, bibl. 23. [Cott. Res. Sta., Namulonge, Uganda]

Plants of BP52 Upland cotton [*Gossypium hirsutum*] which were continuously disbudded up to 23 weeks and 35 weeks after planting, produced an average of 280 and 764 flower buds per plant, respectively. Control plants produced only 112 and 160 flower buds per plant over comparable periods. Disbudded plants produced significantly more flower buds on main-stem sympodia than did control plants ; extensive development of monopodial branches with secondary sympodia also contributed to the increased number of buds produced by treated plants. The data support the theory of cotton plant nutrition by the evidence that maturation of bolls proceeds using nutrients which could otherwise be used for further growth and development of fruiting structure. F. S.—M.H.

1358 LEINWEBER, C. L. and HALL, W. C. **Foliar abscission in cotton. 3. Macroscopic and microscopic changes associated with natural and chemically induced leaf-fall.** *Bot. Gaz.* 1959, **121,** No. 1, 9–16, bibl. 17, illus. [Oklahoma State Univ., Stillwater, and Texas A. and M. Coll., College Station]

Studies on leaf fall in Deltapine 15 cotton showed that differentiation of the abscission zone occurred at a very late stage in leaf maturation.

Hydrolysis of cell walls in the abscission zone occurred at the same time as the rapid formation of tyloses in the xylem on the distal side of the abscission zone. Tyloses were formed on the proximal side only when leaves had fallen. Periderm tissue was formed 5–8 days after leaf fall. Cell division across the abscission zone occurred just prior to leaf fall in the case of natural or endothal-induced defoliation, while little or no such cell division occurred where amitrol or $NaClO_3$/Na metaborate defoliants were used. [See *Fld Crop Abstr.* 12 : 1918 and 12 : 1919].—R.B.

1359 Reddi, J. V. and others. **The occurrence of a pistillate stamen in cotton.** *Andhra agric. J.* 1959, **6**, No. 2, 73–5, bibl. 4, illus. [Cotton Res. Sta., Narasaraopet, India]

1360 Institut de Recherches du Coton et des Textiles Exotiques. Activité de l'IRCT 1957. Le coton. [**The work of IRCT during 1957. Cotton.**] *Cot. et Fibr. trop.* 1959, **14**, No. 2, 77–285, illus.

French Equatorial Africa. Bambari Station, Ubangi-Shari. In a trial which started in 1956 comparison was made between maize, *Canavalia* sp. and *Cajanus cajan*, as preceding crops for cotton ; maize was considered the best because it covers the soil rapidly and yields a large quantity of green matter which is relatively easy to plough-in. If a large amount of green matter is ploughed-in, 100 kg of sulphate of ammonia per ha should also be applied. In a plant density trial with rows 90 cm apart, thinning cotton to 2 plants per stand was better than thinning to 1 plant in most cases. Bossangoa Station, Ubangi-Shari. The multiplication of Allen 150 has continued in the west ; the variety Soumbé A 25 B 9 will be grown in the south of Bossangoa district and in part of Bouca district. Tikem Station, Chad. In a varietal trial, A 151 gave the highest yields of seed cotton ; this variety will be grown throughout the cotton area of the Mayo-Kebbi. Bebedjia Station, Chad. The variety A 150 was grown throughout the cotton area of the Logone and Middle-Chari. In a manurial trial, the yields of seed-cotton per ha were : with sulphate of ammonia at 20 kg N/ha, 2073 kg ; with cattle manure at 20 tons/ha, 1889 kg ; with cotton cake at 1 ton/ha, 1959 kg. From large-scale trials in the Logone and Middle-Chari it is concluded that the minimum rate of N for cotton is 20 kg/ha, which gives increases in yield of 20–30%. Section d'Expérimentation Cotonnière, North Cameroons. The superiority of A 151 over other varieties was confirmed. Results from 4 years' trials showed an advantage from : sowing early (late May-early June) on ridges ; disinfecting the seed by delinting and dusting with granopera ; applying sulphate of ammonia at 100 kg/ha at sowing ; applying cotton-cake as an organic fertilizer at 500 kg/ha at thinning. French West Africa and Togoland. Bouaké Station, Ivory Coast. Mono 54 (*G. barbadense*) will be sown throughout the cotton area of Korhogo. Anié-Mono Station, Togoland. Mono 57 was multiplied. Morocco, Tadla Station. In a varietal trial, Ashmouni A 20, Giza 31 and Tadla 2 (all varieties of *G. barbadense*) yielded significantly more fibre (866 kg, 776 kg and 752 kg per ha, respectively) than the other varieties tested. A study of flowering and boll-formation in the varieties Pima 67 and Coker 100 is in progress. An irrigation trial showed an advantage in continuing irrigation until the end of flowering (15 Sept.). Algeria, Section Textile de Perregaux. The varieties K 55 and K 52 were multiplied. A list is given of cotton weeds, the dominant species being *Beta macrocarpa*. Treatment with the herbicides C 80 and DU 80 was profitable. The best density for cotton is 100,000 plants per ha. Bone Station. Results from an irrigation trial indicated that the irrigation of cotton should begin in late July and should be continued for 5 weeks at a rate of 600 m^3 of water applied every 12–15 days, the total water requirement of cotton being about 2000–2500 m^3. Madagascar, Tuléar province. Mangoky. Irrigated cultivation. The spacing of 1 × 0·40 m gave the highest yields. In a sowing-date trial, Acala 4–42 and Stoneville 2 B yielded 4437 and 4439 kg/ha, respectively, when sown on 24 Dec., and 2336 and 2321 kg/ha, respectively, when sown on 8 March. [See also *Fld Crop Abstr.* 12 : 1441.]—E.B.O.

1361 Jordan, Hashemite Kingdom of. **Cotton.** *7th Ann. Rep. Deir Alla Res. Sta.* 1958, pp. 29–32.

The cotton trials reported (on sowing date, insecticides, and varieties) are the final tests in the series. Cotton production in Jordan is unstable because of the attacks of spring bollworm. The control measures employed have been ineffectual. [See also *Fld Crop Abstr.* 11 : 863.]—M.H.

FIBRE FLAX

1362 Association Technique pour la Production et l'Utilisation du Lin. Compte-rendu des travaux. Année 1958. [**Report on work on fibre flax during 1958.**] 1958, pp. 94, bibl. 5. [Sta. Exp. Plessis-Belleville, Oise, France]

This report includes : A study of the influence of the date of harvesting on the behaviour of fibre flax, by P. Gayet ; A note on drying fibre flax ; A note on retting fibre flax in water to which urea had been added.—E.B.O.

JUTE

See also Abs. 1366.

1363 Tanganyika Agricultural Corporation. **Rufiji Basin Survey Scheme. Trial**

farms. [Fibre crops]. *Rep. Tanganyika agric. Corp.* 1957–8, 84 and 87. [Received Jan., 1960]

At Beta, jute sown in early Dec. gave the highest yield (1187 lb. retted fibre/ac.), but fibre quality was poor. *Hibiscus cannabinus* sown in Dec. or Feb. yielded considerably more than that sown in March or May. At Lumemo, *H. cannabinus* sown in Dec., Jan. and Feb. yielded 700–1780 lb./ac. while that sown in March yielded only 416–585 lb./ac.—A.M.H.

1364 Ghosh, T. and Basak, M. **Method of storing jute seed and effect of age of seed on yield of fibre.** *Indian J. agric. Sci.* 1958, **28**, No. 2, 235–42, bibl. 4.

Seeds of *Corchorus olitorius* and *C. capsularis* were stored for 18 months without loss of viability if they were first dried to a moisture content of 7·2% and stored free from contact with atmospheric moisture, e.g. in plastic-lined containers. Contrary to general belief, plants produced from stored seed did not flower earlier than was normal for a variety, and yields were approximately the same as from fresh seed, provided the seed rate had been adjusted to the percentage germination determined shortly before sowing the crop.—D.B.

KENAF

See also Abs. 1363.

1365 Institut de Recherches du Coton et des Textiles Exotiques. Activité de l'IRCT 1957. Les succédanés du jute. [**The work of IRCT during 1957. Jute substitutes.**] *Cot. et Fibr. trop.* 1959, **14**, No. 2, 287–301, illus.

Morocco, Tadla Experimental Centre. A trial was carried out to compare the *Hibiscus cannabinus* var. Deroua red, Deroua pink, Soudan late and Soudan early. Differences in green-matter yields were not significant, but Soudan early, which yielded 3318 kg fibre with 15% moisture per ha, was significantly better than the other varieties in fibre content (5·2%). The characteristics of these varieties are given. Cutting at the beginning of flowering gave fibre of a finer quality, but slightly less strong, than that obtained by cutting when the plants were in full flower. Algeria, Textile Section of Perregaux, Hamadena. In a plant density trial with *H. cannabinus*, the highest yield of dry fibre, 2360 kg/ha, was obtained from a density of 790,000 stems per ha, which resulted from sowing 40 kg of seed per ha. These stems were also the tallest (167 cm) and the thickest (9 mm diameter). [See also *Fld Crop Abstr.* 12 : 1450.]—E.B.O.

1366 Seale, C. C. and others. **Agronomy, breeding and pathology investigations of fiber crops.** *Ann. Rep. Fla Agric. Exp. Stas* 1958, 279–81.

In tests at Belle Glade, Florida, with 5 varieties of kenaf (*Hibiscus cannabinus*) and 1 variety each of *Corchorus capsularis* and *C. olitorius*, kenaf gave significantly greater yields of fibre than did jute. The kenaf variety BG. 52–1 yielded 2066 lb. fibre/ac.—R.B.

1367 Caluya, Maria F. and Imlan, J. S. **Effect of gibberellic acid on the fiber of kenaf (*Hibiscus cannabinus* L.).** *Philipp. Agriculturist* 1959, **43**, No. 5, 369–72, illus.

Seedlings of kenaf 2 weeks old were treated 5 times at weekly intervals with 1 drop of 10, 50 or 100 ppm. aqueous GA solution. At 7 weeks old, untreated plants and plants given 10, 50 or 100 ppm. GA were 10·5, 18·5, 23 and 23 cm tall, and contained 3·5, 3·7, 4·2 and 4·1% fibre on a dry-weight basis, respectively. Respective fibre yields per plant were 1·5, 1·8, 2·6 and 2·6 g. The treatments had no significant effect on fibre strength.—R.B.

1368 Summers, T. E. and Randolph, J. W. **Biological retting of bast fibers.** *Ann. Rep. Fla Agric. Exp. Stas* 1958, 283–4.

Four methods of retting kenaf were investigated at Belle Glade, Florida. In canal retting, green ribbons of kenaf folded over poles and suspended loosely beneath the surface of the water retted well within 10 days. The fibre was easily cleaned and had a tensile strength of 40,000 lb./sq. in. When tightly bundled and held at the bottom of the canal by weights, the ribbons retted more slowly and produced less uniform fibre. Retting in concrete tanks produced fairly good though not uniform fibre in approximately 8 days. Artificial heating, and replacement of 50% of the water after 2–3 days, reduced the retting time to 5–6 days. The fibre had an average tensile strength of 34,200 lb./sq. in. Stack retting, in which piles of kenaf 3–4 ft. high were kept wet by means of a rotating sprinkler, produced unsatisfactory fibre with a tensile strength of 16,500 lb/sq. in. Retting in moist chambers took 3 days when the material was inoculated with a fungus culture, compared with 6 days without inoculation, and good quality fibre with a tensile strength of 34,500 lb/sq. in. was produced. The moist-chamber method of retting requires further investigation before being applied commercially.—R.B.

OIL CROPS

SESAME

1369 Tanganyika Agricultural Corporation. **Rufiji Basin Survey Scheme. Trial farms. [Oil crops].** *Rep. Tanganyika agric. Corp.* 1957–8, 85 and 93. [Received Jan., 1960]

At Beta, the highest yield of sesame (717 lb./ac.) was from Venezuela 52 sown in Feb. At Rujewa, Nov. and Dec. sowings yielded most (200–240 lb./ac.), more than twice as much as Feb. and March sowings.—A.M.H.

1370 Hanawa, J. **Leaf development following longitudinal split of the shoot apices of the germinating embryo and the seedling in *Sesamum indicum* L.** *Bot. Mag. Tokyo* 1959, **72**, Nos. 857–8, 425–31, bibl. 9, illus. [Tokyo Metropolitan Univ., Japan]

1371 Pal, N. L. and Bangarayya, M. **Deficiency symptoms in *Sesamum indicum* L. (gingili). Symptoms produced by deficiency of nitrogen, phosphorus, potassium, calcium and magnesium.** *Indian J. agric. Sci.* 1958, **28**, No. 4, 607–11, bibl. 4, illus. [Central Tobacco Res. Inst., Rajahmundry, Andhra State]

OIL-SEED FLAX

1372 Marciotte, C. V. Consejos prácticos para la siembra del lino. [**Practical advice on sowing oil-seed flax (in Argentina).**] *Bol. Divulg. 6 Esta. exp. Pergamino* 1959, pp. 14, illus.

1373 Friederich, J. C. La désinfection des semences de lin. [**The disinfection of flax seed.**] *Fibra* 1959, **4**, No. 3, 71–84, bibl. 15, illus., English and German summaries. [The Netherlands]

An account is given of work carried out during recent years.—E.B.O.

1374 Khan, A. R. and Gupta, G. P. **Effect of some plant nutrients on yield of linseed and quality of its products.** *Indian Oilseeds J.* 1959, **3**, No. 4, 221–5, bibl. 28. [Indian Agric. Res. Inst., New Delhi]

N as $(NH_4)_2SO_4$, either alone or with P_2O_5, increased yields of linseed by 22·6% over control (no fertilizer). At 30 lb. N/acre the response was at the rate of 12·36 lb. linseed per lb. N. Phosphate at 60 lb. P_2O_5 per acre did not increase seed yields but increased oil content of seeds. Mn (as $MnSO_4$) increased seed yields and oil content ; B (as borax) depressed these. Fertilizers had little effect on iodine number. Fibre content of the plant was unchanged by N but was decreased by other treatments, especially when P_2O_5 or B were given alone.—D.B.

SAFFLOWER

1375 Beech, D. F. **Safflower. An oil crop for the Kimberleys.** *J. Dep. Agric. W. Aust.* 1960, **1**, No. 3, 181–7, illus.

As a result of experiments at Kimberley Research Station, recommendations are made for the cultivation of safflower (*Carthamus tinctorius*).—S.M.J.

SUNFLOWER

See also Abs. 1380, 1396, 1402.

1376 Dyer, H. J. and others. **Photoperiodic behavior of sunflower.** *Bot. Gaz.* 1959, **121**, No. 1, 50–5, bibl. 8. [Brown Univ., Providence, R.I. and Argonne Nat. Lab., Lamont, Illinois]

Sunflowers [*Helianthus annuus*], var. Mammoth Russian, were grown under photoperiods ranging from 8 to 20 hr., or with 12 hr. photoperiods with the dark period interrupted by 0·25 or 1 hr. light. Short photoperiods promoted flowering by hastening the initiation of flower primordia and by hastening their further development. Interruption of the dark period inhibited floral initiation and development. Flowering eventually occurred under all photoperiodic treatments, provided that the plants were grown for a sufficiently long time. There was a wide variation between individual plants in the time required for flowering to take place under any one photoperiodic treatment. Stem elongation was more rapid under long than under short photoperiods.—R.B.

MUSTARD

1377 Vaughan, J. G. and Hemingway, J. S. **The utilization of mustards.** *Econ. Bot.* 1959, **13**, No. 3, 196–204, bibl. 29.

The growing of *Brassica nigra*, *B. juncea*, *Sinapis alba*, *S. arvensis* and *Eruca sativa* for oil, soil cover and green manure is reviewed.—R.B.

SARSON

1378 Srivastava, R. N. and Narain, B. **Time of bud pollination in self-incompatible *B. campestris* var. brown sarson.** *Indian Oilseeds J.* 1959, **3**, No. 3, 152–4, bibl. 4. [Dep. Agric., Bihar]

Self-sterility in *Brassica campestris* var. brown sarson was largely overcome by pollinating the stigmas, 2 days before normal anthesis and with the flowers still in bud, with pollen from an open flower of the same plant. Percentage fertilization when pollinated on day of, and 1, 2, 3, 4 and 5 days before, anthesis was 5·9, 53·4, 61·3, 42·9, 29·2 and 14·4. These findings agree with results of similar experiments on *B. oleracea* var. *campestris*. It is assumed that a substance which inhibits growth of the pollen tube appears during the 24 hr. before flower opening.—D.B.

CNICUS BENEDICTUS

1379 Ruszkowski, M. Studia nad nową rośliną oleistą, drapaczem lekarskim (*Cnicus bene-*

dictus Gaert). Morfologia, biologia, agrotechnika i ocena wartości użytkowej. [**Studies on the new oil-plant *Cnicus benedictus* Gaert. Its morphology, biology, culture and utility.**] *Ann. Univ. M. Curie-Skłodowska 1957* Sect. E, 1959, **12,** 319–60, bibl. 35, English summary.

The growth habit of this plant is described and measures for its cultivation outlined. Optimal conditions for the plant's growth and development include a cold spring, a wet May and a dry, warm July and August. When the crop is sown in spring (as soon as soil moisture permits) seed does not ripen until the end of August. The oil content of the seed ranges between 28 and 32%. F. Eng. s.—M.H.

GENERAL

1380 Jordan, Hashemite Kingdom of. **Oil seeds.** *7th Ann. Rep. Deir Alla Res. Sta.* 1958, 32–41.

The seeds were safflower, sunflower, sesame and linseed. Tests, under irrigation, included : varieties, spacing, sowing-rate and -date, and fertilizers. The data are tabulated. The results for sunflower were obscured by bird attack (30–90% loss) ; further tests are necessary on safflower sowing date ; introduced varieties of sesame were attacked by *Fusarium* wilt and only the local variety was satisfactory (yield of 134 kg/ha) ; early sowing (12 Jan.) is best for linseed. [See also *Fld Crop Abstr.* 11 : 863.]—M.H.

CROP BOTANY

PHYSIOLOGY

1381 Dubetz, S. and others. **The effect of fertilizers and osmotic pressure on germination.** *Canad. J. Soil Sci.* 1959, **39,** No. 2, 157–64, bibl. 11. [Canada Agric. Res. Sta., Lethbridge, Alberta, and Utah State Univ., Logan]

Maize and sugar-beet were sown in a glasshouse in soil given (a) no fertilizer, (b) 50 lb. P_2O_5/ac., (c) 50 lb. P_2O_5/ac. plus 25 lb. N/ac., (d) 50 lb. P_2O_5/ac. plus 50 lb. N/ac., (e) mannitol equal in molarity to treatment (c). The soils were maintained at 25, 50 or 75% of available moisture retaining capacity. Moisture level alone had no effect on germination. Treatment (b) reduced germination at the 25% level of available moisture only. At 75% available moisture, treatment (c) significantly reduced percentage germination of sugar-beet, but not that of maize. All other combinations of N treatments and soil moisture significantly reduced germination in both crops, but to a greater extent in sugar-beet than in maize. At 25% available moisture, practically no germination occurred in treatments (c) and (d). Mannitol reduced percentage germination less than did N + P. [See *Abs.* 759.]—R.B.

1382† Bürgin-Wolff, Annemarie. Untersuchungen über die Infektion von Wurzeln durch Knöllchenbacterien. [**Root infection by nodule bacteria.**] *Ber. schweiz. bot. Ges.* 1959, **69,** 75–111, bibl. 56, illus. [Bot. Inst., Univ. Basel]

Infection with Rhizobia and subsequent nodule formation, or its failure, were studied in legumes (*Pisum sativum*, *Medicago sativa*, *Trifolium pratense* and *T. subterraneum*) and in non-legumes (*Helianthus annuus* and *Zea mays*). Infection could be diagnosed in root hairs 20 hr. after the roots had been in contact with the Rhizobia. In peas the number of nodules formed was only one-half or one-third the number of infected root hairs. Nodules developed only in those parts of a root which grew after the infection. High concentrations of nitrate in the medium hindered nodule formation, but not infection. Clover Rhizobia infected the root hairs of peas, but failed to produce nodules. Nodule formation (but not infection) is determined by the higher plant rather than the bacteria.—D.B.

1383† Lange, R. T. and Parker, C. A. **Nodulation patterns on legumes.** *Nature, Lond.* 1960, **186,** No. 4719, 178–9, bibl. 3. [Inst. Agric., Univ. W. Australia]

Observations made on *Lupinus angustifolius*, *L. digitatus*, *L. luteus* and *L. mutabilis* show that legume species may exhibit preferential and differing nodulation patterns under uniform conditions and that this may apply intragenerically to annuals of similar rooting habit. [See also *Herb. Abstr.* 26 : 1281.]—M.H.

1384† Saeki, T. **Interrelationships between leaf amount, light distribution and total photosynthesis in a plant community.** *Bot. Mag. Tokyo* 1960, **73,** No. 860, 55–63, bibl. 20. [Bot. Inst., Univ. Tokyo, Hongo, Tokyo, Japan]

Mathematical equations are produced to express the interrelationships mentioned above.—D.B.

1385 Doi, Y. and Kimura, M. **Observation on protoplasmic streaming in the cells of crop plants. 1. Protoplasmic streaming in various hair cells.** [Japanese] *Bull. Fac. Agric., Yamaguti* 1959, No. 10, 1225–34, bibl. 14, illus., English summary.

The plants and their parts studied included : *Oryza sativa* (palea, lemma, auricle) ; *Triticum*

vulgare (auricle) ; *Zea mays* (leaf blade and root hair) ; *Setaria italica* (leaf sheath and root hair) ; *Daucus carota* (petiole) ; *Gossypium herbaceum* (lint); and *Hibiscus manihot* (leaf). Notes and illustrations are given in each case.—D.B.

1386 MEHTA, B. V. and DESAI, R. S. **Salt tolerance studies : effect of soil salinity on the growth and chemical composition of plants. 1.** *J. Soil Wat. Conserv. India* 1959, **7**, No. 2/3, 101–5, bibl. 21. [Inst. Agric., Anand]

Salt tolerance, judged by yield and survival, were studied in *Pennisetum typhoideum*, *Cyamopsis tetragonoloba*, *Gossypium herbaceum*, *Pisum sativum*, and *Dolichos lablab* [*Lablab niger*]. The salts used in these pot experiments were NaCl and $CaCl_2$. Descriptions of plant behaviour and yields (per 5 plants) under different soil salinities are tabulated. For a given salinity, reduction in yield was greater with NaCl than with $CaCl_2$. The 3 first-named plants were very tolerant to salts, the remaining 2 were only slightly tolerant.—D.B.

1387 MEHTA, B. V. and DESAI, R. S. **Salt tolerance studies : Effect of soil salinity on the growth and chemical composition of plants. 2.** *J. Soil Wat. Conserv. India* 1959, **7**, No. 2/3, 106–15, bibl. 29.

The cation composition of leaves of plants (named in previous abstract) grown under soil salinities of 1 increased by 0·25 to 2·5% NaCl and $CaCl_2$ (calculated at field moisture capacity) are tabulated. As the concentrations of NaCl increased, the content of Ca and Na increased but the content of K and Mg decreased. The relationship between the total cation content and tolerance to salinity are discussed.—D.B.

GROWTH

1388 NJOKU, E. **An analysis of plant growth in some West African species. 1. Growth in full daylight.** *J. W. Afr. Sci. Assoc.* 1959, **5**, No. 1, 37–56, bibl. 22. [Dep. Bot., Univ. Coll., Ibadan, Nigeria]

In pot experiments in Nigeria with 10 W. African spp., *Zea mays* had a high net assimilation rate (1·5 g /dm²/week), which compensated for its relatively low leaf-area ratio. Its relative growth rate was lower than that of *Vigna unguiculata* under the same conditions. High net assimilation rates and leaf-area ratios indicated that spp. of maize and *V. unguiculata* grow faster in W. Africa in temperate zones under similar conditions of nutrient supply and moisture.—S.M.J.

1389 BERRIE, A. M. M. **Abnormal growth and development in pea resulting from exposure to adverse conditions during germination.** *Nature, Lond.* 1960, **185**, No. 4713, 626–7, bibl. 1, illus. [Bot. Dep., Univ. Glasgow]

Under conditions of the tests in which *Pisum sativum* seeds were germinated in moist soil, running water, stagnant water, and 20% carbon monoxide, it is concluded that the normal course of development in the plant can be altered by exposing the seed during germination to conditions which affect aerobic respiration. The result is the removal of apical dominance. The meristems in the embryo are the tissues most affected.—M.H.

1390 LOCKHART, J. A. **Studies on the mechanism of stem growth inhibition by visible radiation.** *Pl. Physiol.* 1959, **34**, No. 4, 457–60, bibl. 9. [Calif. Inst. Technol., Pasadena]

1391 DANG, K.-D. Conséquences de mutilations experimentales sur la croissance, l'anatomie, l'hydratation et la floraison de quelques espèces de lin. [**Consequences of experimental injury on the growth, anatomy, water balance and flowering of some species of flax.**] *Ber. schweiz. bot. Ges.* 1959, **69**, 346–467, bibl. approx. 800, illus., English summary. [Univ. Genève]

In *Linum usitatissimum*, *L. angustifolium* and *L. austriacum* the changes in growth of shoot and root, anatomy, water balance and time of flowering were observed after defoliation and removal of lateral branches of root and shoot. The plant's adaptations were used as a means of studying plant life. F. S.—D.B.

1392† LOPATIN, V. D. [**The prospects of raising the yields of crops by aeration of water-saturated soils without removing the water.**] [Russian] *Bot. Ž., SSSR*, (*Bot. J., USSR*) 1959, **44**, No. 11, 1673–6, bibl. 27. [Forestry Inst., Karelia Filial Acad. Sci. USSR, Petrozavodsk]

These prospects are based on the assumptions that : (1) water removed from the soil during drainage operations is not surplus for plant life, but, on the contrary, is vital to it ; (2) only by constant and unlimited water supply can plants attain their maximum activity and make the maximum use of the sun's radiation ; (3) plants which are under conditions allowing maximum photosynthesis (abundant light and warmth) suffer from water deficiency, so that even in a wet climate (e.g. that of Karelia) the highest crop yields are obtained only with irrigation. Literature bearing on these points is reviewed. Experimental work is required on methods of aerating water-saturated soil.—M.H.

GROWTH SUBSTANCES

See also Abs. 1096, 1183, 1184, 1271, 1272, 1311, 1367.

1393 BRIAN, P. W. **New light on the gibberellins.** *New Scient.* 1960. **7**, No. 169, 322–4.

Earlier work on gibberellin is reconsidered in the light of the discovery that it is a natural plant hormone. Changes in the balance of complex systems of gibberellin and other hormones affect the growth and dormancy cycles of plants. When internodal sections of *Pisum sativum* were treated with sucrose and IAA, with or without gibberellin, the effect of IAA + gibberellin was synergistic. An increase in gibberellin content promotes increased vegetative growth in all plants, and usually initiates flowering in long-day plants, but prevents flowering in short-day plants. Gibberellin accentuates the physiological reaction of plants to light intensity and will induce the germination in darkness of seeds which normally require light.—S.M.J.

1394 Murakami, Y. **The occurrence of gibberellins in mature dry seeds.** *Bot. Mag. Tokyo* 1959, **72,** 857–8, 438–42, bibl. 6. [Nat. Inst. Agric. Sci., Nishigahara, Kita-Ku, Tokyo, Japan]

Using the paper chromatography method, gibberellins were found in the extracts of mature dry seeds of *Helianthus annuus*, *Ipomoea batatas*, *Lupinus luteus* and *Vicia faba*.—D.B.

1395 Sudia, T. **Influence of temperature on the response of germinating barley grains to potassium gibberellate.** *Pl. Physiol.* 1959, **34,** No. 4, 473–5, bibl. 18. [Inst. Agric., Univ. Minnesota, St. Paul 1]

1396 León, A. de and Ráfols, W. de. El ácido giberélico. [**Gibberellic acid.**] *An. Inst. nac. Invest. agron.* 1959, **8,** No. 4, 807–45, bibl. 16, illus., English summary.

In glasshouse and field trials near Madrid, treatment of young plants of several species, including soyabeans, wheat and sunflower, with gibberellic acid resulted in general in a greater vegetative growth, earlier flowering and larger seeds than in the untreated controls. F.s.—E.B.O.

1397 Atal, C. K. **Sex reversal in hemp by application of gibberellin.** *Curr. Sci.* 1959, **28,** No. 10, 408–9, bibl. 6, illus. [Punjab Univ., Amritsar, India]

Spraying *Cannabis sativa* seedlings at weekly intervals with a 100 ppm. aqueous solution of gibberellin induced the formation of male and hermaphrodite flowers in genetically female plants. It is thought that this is the first report of gibberellin causing sex reversal in a dioecious species.—D.B.

1398† Kosikova, P. G. [**Germination of the seeds of some weeds and ruderal plants when treated with gibberellic acid in different concentrations.**] [Russian] *Doklady Akad. Nauk SSSR* (*Proc. Acad. Sci. USSR*) 1960, **130,** No. 4, 922–4, bibl. 4. [Stavropol Agric. Inst.]

Tests with approx. 20 weed species showed that the effect of GA on seed germination varied between species. In most cases germination was stimulated and increased as the concentration of GA increased from 0·001 to 0·03%. The effect of GA on the seed of *Thlaspi arvense* was obscure.—M.H.

1399 Lockhart, J. A. and Gottschall, Virginia. **Growth responses of Alaska pea seedlings to visible radiation and gibberellic acid.** *Pl. Physiol.* 1959, **34,** No. 4, 460–5, bibl. 12. [Calif. Inst. Technol. Pasadena]

1400 Eliasson, L. **Growth response of pea roots to 2,4-D applied to the hypocotyl.** *Physiol. Plant.* 1959, **12,** No. 4, 834–40, bibl. 9, illus. [Forest Res. Inst., Stockholm]

The application of 0·1μg 2,4-D to *Pisum sativum* hypocotyls inhibited elongation of the roots 4–5 hr. later. Localised swellings appeared a few mm above the root tip during the first 24 hr. following treatment. Lateral roots developed rapidly. Applications of 1 or 10μg 2,4-D resulted in a greater degree of inhibition and swelling of the whole root than did applications of 0·1μg 2,4-D. Roots growing on moist filter paper gave a greater response than roots continously washed with 2,4-D solution which indicated that, in the presence of 2,4-D, a leachable growth-inhibiting substance is formed in the roots.—S.M.J.

1401 Key, J. L. and Galitz, D. S. **Growth inhibitor in immature soybean seeds and 2,4-D-sprayed soybean seedlings.** *Science* 1959, **130,** No. 3385, 1340–1, bibl. 7. [Univ. Illinois, Urbana]

A naturally occurring inhibitor of seed germination, isolated from seeds and seedlings of soyabeans by ion-exchange chromatography, increased in concentration in the seedlings when these were sprayed with 2,4-D, but decreased rapidly in untreated seedlings. There was a positive correlation between the concentration of the growth inhibitor in seedlings and the extent of growth inhibition where 2,4-D was applied. The substance was thought to inhibit growth by suppressing ATP production.—R.B.

1402 Appalanaidu, B. **Studies on the effects of 2,4-dichlorophenoxyacetic acid on *Brassica kaber* D.C., *Hibiscus esculentus* L., and *Helianthus annuus* L.** *Diss Abstr.* 1959. **20,** No. 3, 858. [Kansas State Univ., Manhattan]

1403† Arnold, C.-G. Antibiotische Stoffe aus Pflanzen-Samen. [**Antibiotic substances from plant seeds.**] *Z. Bot.* 1958, **46,** No. 5–6, 516–49, bibl., illus. [Bot. Inst., Univ. Erlangen, W. Germany]

The plants reported on include *Beta vulgaris*, *Helianthus annuus*, *Lupinus polyphyllus* and *Papaver somniferum*. This is a general article.—D.B.

1404 Linser, H. and others. Der Wuchsstoffgehalt verschiedener *Brassica* Pflanzen in Abhängigkeit von ihrem Entwicklungszustand. [**The growth-substance content of various *Brassica* spp. in relation to their stage of development.**] *Planta* 1958, **52,** No. 2, 173–86, bibl. [Biol. Forschungsabteilung der Österreichische Stickstoffwerke A.G., Linz a.d. Donau, Austria]

1405 Torrey, J. G. **A chemical inhibitor of auxin-induced lateral root initiation in roots of *Pisum*.** *Physiol. Plant.* 1959, **12,** No. 4, 873–87, bibl. 31. [Bot. Dep., Univ. California]

Two ether- and alcohol-soluble inhibitors (unidentified) of IAA-induced root initiation in *Pisum sativum* were extracted from seedling roots and separated by paper chromatography.—s.m.j.

1406 Pilet, P. E. and Kobr, M. Étude de l'inhibition de la croissance radiculaire par le DL-tryptophane [DLT]. [**Inhibition of root growth by DL tryptophane.**] *Ber. schweiz. bot. Ges.* 1958, **68,** 239–48, bibl. 32.

DLT at concentrations of 10^{-7}–10^{-3}M, applied at the beginning of germination of *Lens culinaris*, inhibited root growth. This inhibition increased with concentration of solution and with earliness of treatment. On transference to a DLT-free medium, the inhibition ceased.—d.b.

1407 Bennet-Clark, T. A. and Wheeler, A. W. **The metabolism of 3-indolylacetic acid in plant tissues.** *J. exp. Bot.* 1959, **10,** No. 30, 468–79, bibl. 10. [Bot. Dep., Kings Coll., London]

1408 Canvin, D. T. and Friesen, G. **Cytological effects of CDAA and IPC on germinating barley and peas.** *Weeds* 1959, **7,** No. 2, 153–6, bibl. 8, illus. [Univ. Manitoba, Winnipeg, Canada]

Concentrations of 1, 10 and 100 ppm. CDAA inhibited cell division in barley roots, but the effect on pea roots was slight. Similar solutions of propham completely inhibited cell division in barley and at the 2 higher concentrations caused abnormalities. They also inhibited cell division in pea roots to some extent.—j.d.j.

1409 Seed World. **New growth regulating chemical discovered at Michigan State University.** *Seed World* 1959, **85,** No. 9, 10, 12.

Wheat plants treated with 2-chloro-ethyltrimethylammonium chloride, a recently discovered growth regulator, were less tall, darker green in colour and produced more tillers than untreated plants. This chemical reduces internode length in a number of plants.—r.b.

1410 Dekker, J. and Ark, P. A. **Penetration and stability of GS-1 in plant tissue.** *Physiol. Plant.* 1959, **12,** No. 4, 888–92, bibl. 3, illus. [Dep. Pl. Path., Univ. California]

Seeds of *Pisum sativum*, *Phaseolus vulgaris*, *Vigna sinensis* and *Zea mays* were soaked in an aqueous solution of 100 ppm. GS-1 (2 – (l'oxy-2-pyridylthio) imidozoline hydrobromide) for 24 hr. and assayed against *Glomerella cingulata*. All the cotyledons contained large inhibition zones, which indicated penetration of the seed coats by GS-1. Fungicidal activity was completely inhibited in seeds which were treated with GS-1 and then kept in a moist environment for 10–48 hr.—s.m.j.

NUTRITION

1411 Hasegawa, S. and others. **Comparison of the moisture extraction patterns of some crops.** [Japanese] *Proc. Crop Sci. Soc. Japan* 1959, **28,** No. 1, 63–5, bibl. 13, English summary. [Kanto-Tosan Agric. Exp. Sta.]

The maximum daily rates of water absorption from the soil by upland rice, sweet-potato and soyabean were, respectively, 7, 6 and 6 mm. While upland rice obtained most of its moisture from the upper 15-cm layer of soil, sweet-potato obtained more from a depth of 15–30 cm. This general pattern varied throughout a season. In this volcanic ash and clay loam soil, water at a depth of 40–50 cm was drawn on when about 50% of available moisture at higher levels had been used. The information was used to improve efficiency in the use of irrigation water. F. Eng. s. —d.b.

1412 Tezuka, Y. **The influence of nutrients on the growth of plant populations under different densities. Relations of plant communities to edaphic factors with special reference to mineral nutrition. 3.** *Bot. Mag. Tokyo* 1960, **73,** No. 859, 7–13, bibl. 14, illus., Japanese summary. [Tokyo Metropolitan Univ., Japan]

This study of the relationship between density of population, available nutrients and plant growth was made on *Brassica cernua* grown in water culture and *Fagopyrum esculentum* grown in field plots.—d.b.

1413 Hovland, D. and Caldwell, A. C. **Potassium and magnesium relationships in soils and plants.** *Soil Sci.* 1960, **89,** No. 2, 92–6, bibl. 17. [Minnesota Agric. Exp. Sta.]

The foliage of potatoes and sugar-beet grown on plots dressed with a K fertilizer was not as dark a green as that on plots which received no K. It was suggested that this might be due to a lessened Mg content induced by high K. Relationships of K manuring, contents of Mg and K in plants, and ease of replacement of soil Mg were studied in soil and plant samples. Mg content was lower in plants

grown on soils treated with K than in plants from untreated soils. F. s.—E.B.O.

1414 Linck, A. J. and Swanson, C. A. **A study of several factors affecting the distribution of phosphorus-32 from the leaves of *Pisum sativum*.** *Plant and Soil* 1960, **12**, No. 1, 57–68, bibl. 17, illus. [Ohio State Univ., Columbus]

Alaska peas were grown under controlled environmental conditions for 50 days, a drop of aqueous H_3PO_4 solution containing 4–6 μc ^{32}P was applied to one leaflet of each plant tested, and plants were sampled 3–7 hr. later. ^{32}P was translocated in the phloem. Where the solution was applied at the first flowering (10th) node, 50–90% of the ^{32}P was translocated to the pod at that node. Translocation to pods at higher nodes was negligible. Translocation of ^{32}P from lower (5th or 7th) nodes was predominantly downwards, with little or no accumulation in the pods. In a similar experiment in which the plants were beginning to flower, very little ^{32}P moved from the leaf at the flowering node into the flower or the vegetative parts of the plant before anthesis or fertilization had occurred. Where the plants were treated 4 days after anthesis, large amounts of ^{32}P were present in all parts of the flower and in the vegetative parts of the plant within 3–4 hr. of treatment. In plants where the temperature of the pod at the first flowering node was reduced to 7°C. 30–60 minutes before applying ^{32}P, and maintained at this temperature for 3–4 hr. while the remainder of the plant was at 26°C., translocation of ^{32}P to this pod and to other parts of the plant was markedly diminished, except where other pods, at 26°C., were also present on the plant. In plants with 2 pods, lowering the temperature of the first pod substantially increased the amount of ^{32}P translocated to the second pod.—R.B.

1415 Emmert, F. H. **Loss of phosphorus-32 by plant roots after foliar application.** *Pl. Physiol.* 1959, **34**, No. 4, 449–54, bibl. 14. [Pl. Sci. Dep., Univ. Connecticut, Storrs]

Root loss of ^{32}P to a graded series of P solutions and to water was studied over a long (7 day) and a short (50 min.) time-interval. Intact bean plants were used in which the isotope was introduced through the foliar tissue. F. s.—D.B.

CHEMICAL COMPOSITION

1416 de Vuyst, A. and Vervack, W. Étude de la composition en acides aminés des fourrages produits en Belgique. [**Study of the amino-acid composition of fodder produced in Belgium.**] *Qual. Plant. et Materiae veg.* 1960, **6**, Nos. 3–4, 243–60, bibl. 16, English and German summaries. [Cent. Rech. Zootech., Univ. Louvain, Lovenjoul, Belgium]

Data are presented on the chemical composition of the crude-protein fraction in the grain of wheat, oats, barley, rye, maize, and in potatoes, var. Record.—R.B.

TECHNIQUES AND APPARATUS

See also Abs. 1205, 1298.

1417 Dal Monte, G. Sul metodo radiografico per la scoperta delle infestazioni nei semi. [**On the radiographic method for detecting infestations in seeds.**] *Suppl. Ann. Sper. agr.* 1960, **14**, No. 1, 39–52, bibl. 12, illus., English summary. [Minist. Agric., Italy]

The results are given of X-ray analyses in 1957–8 of 145 samples of wheat imported into Italy, with the main object of detecting infestations by pests in the interior of the seed.—E.B.O.

1418† Fountaine, E. R. and Brown, N. J. **A 2000-litre soil respirometer.** *J. agric. Engng Res.* 1959, **4**, No. 4, 307–11, bibl. 5, illus., French and German summaries. [Soil Dep., NIAE]

An apparatus is described for measuring the respiration of very large soil samples in the field. A preliminary experiment in which kale was grown in the respirometer is described. F. s.—S.M.J.

1419† Tanner, C. B. **Energy balance approach to evapotranspiration from crops.** *Proc. Soil Sci. Soc. Amer.* 1960, **24**, No. 1, 1–9, bibl. 26, illus. [Univ. Wisconsin, Madison]

Evapotranspiration can be reliably estimated over short intervals of time by measuring the vertical energy balance. Estimates of daily evapotranspiration can be obtained by this method provided that periods of positive and negative net radiation are considered separately or that the ratio between heat losses by convection and those by radiation can be estimated for 24-hr. periods. This method is unsuitable for small plots owing to horizontal displacement of heat by air currents. Apparatus for measuring vertical energy balance is described and illustrated.—R.B.

1420 Groenewegen, H. and Mills, J. A. **Uptake of mannitol into the shoots of intact barley plants.** *Aust. J. biol. Sci.* 1960, **13**, No. 1, 1–4, bibl. 7, illus.

At given osmotic pressures, barley plants grown in mannitol solutions wilted more severely than those grown in NaCl solutions, but after transference to a basic nutrient solution, they recovered quickly and mannitol was excreted from the leaves in the guttation water. It was concluded that mannitol is not suitable for imposing a water stress on intact plants for any considerable length of time. F. s.—S.M.J.

1421† Hughes, A. P. **Plant growth in controlled environments as an adjunct to field studies. Experimental applications and results.** *J. agric. Sci.* 1959, **53,** Pt. 2, 247–59, bibl. 10.

The use of plant growth cabinets is discussed. A description is given of a cabinet which provides for variations in day length, temperature (10–25°C.), humidity (50–100% R.H.), spectral composition and light intensity up to an equivalent of one-fifteenth of full noon sunlight. F. s.—s.m.j.

1422† Zahn, G. and Friedrich, T. Ein Lichtthermostat mit luftfeuchtigkeitsregelung. [**A light-thermostat with an air-humidity regulator.**] *Z. PflKrankh.* 1960, **67,** No. 3, 154–7, bibl. 5, illus., English summary. [Inst. Phytopath., Aschersleben, E. Germany]

This apparatus can be used for maintaining a constant environment (light, temperature and air humidity) in physiological and ecological experiments in biological studies.—d.b.

1423† Lecompt, M. Tests rapides pour le contrôle sur le terrain de la nutrition minérale des plantes cultivées. [**Rapid tests for controlling the mineral nutrition of crops in the field.**] *C.R. Acad. Agric. Fr.* 1959, **45,** No. 16, 802–10, bibl. 6. [Inst. Nat. Agron., France]

This article examines and discusses rapid tests for determining the amounts of N, P and K in the sap of plants. It is concluded that first results obtained in France with these tests are encouraging, but that further studies are needed before they can be used in practice for determining the fertilizer requirements of crops. [See also *Abs.* 1425.]—e.b.o.

1424† Jouis, E. and Legacheux, M.-T. Recherches sur des méthodes de dosage pratique des oligoéléments, cuivre, zinc, manganèse dans les plantes et dans les sols en vue d'applications de routine dans les laboratoires agricoles. [**Investigations on methods for the practical determination of Cu, Zn and Mn in plants and soils with a view to routine determinations in agricultural laboratories.**] *Ann. agron., Paris* 1959, **10,** No. 3, 349–65, bibl. 10, English, German and Russian summaries. [Sta. Agron., Rouen, France]

1425 Delmas, J. and others. Contrôle de la nutrition des plantes par l'analyse minérale du suc. [**Control of plant nutrition by means of the chemical analysis of the sap.**] *C.R. Acad. Agric. Fr.* 1959, **45,** No. 16, 796–802.

A description is given of a rapid laboratory and field method for determining the level of nutrition of plants, at different growth stages, by means of sap analysis. First results obtained with potatoes, oats and maize in south-west France are given. [See also *Abs.* 1423.]—e.b.o.

1426† Pilet, P. E. and Meylan, A. Une méthode de mesure de surface foliaire. [**A method of measuring leaf area.**] *Ber. schweiz. bot. Ges.* 1958, **68,** 307–14. [Lab. Physiol. vég., Univ. Lausanne]

The principle of the method is that a leaf placed between a source of light and a photo-electric cell reduces the intensity of light falling on the cell. As the size of leaf increases, the light intensity recorded by the cell diminishes. The method was designed for studying the effect of auxins and their inhibitors on plant growth, including leaf size.—d.b.

1427† Monteith, J. L. and Szeicz, G. **The performance of a Gunn-Bellani radiation integrator.** *Quart. J. R. met. Soc.* 1960, **86,** No. 367, 91–4, bibl. 4. [Rothamsted Exp. Sta., Harpenden]

RADIOBIOLOGY

See also Abs. 1269, 1323, 1390, 1399, 1427.

1428 Süss, A. [**The effect of ionizing radiation on plant growth and yield.**] [German] *Atompraxis* 1959, **5,** 219–23. [Abstracted in] *Nuclear Sci. Abstr.* 1959, **13,** No. 20, 2372–3. [Bayer. Landesanst. Pflbau PflSchütz, Munich]

Seed of spring barley and spring wheat was exposed to (a) 10^4r gamma radiation and 2×10^{15} neutrons/cm^2, (b) 400 mr gamma radiation. Barley given treatment (a) died after 3 weeks' growth. Similarly treated wheat produced stunted, abnormal plants. Wheat given treatment (b) yielded 6·1% more dry matter after 14 days growth, and 5·5% more grain and 4·4% more straw, than did untreated controls. Treatment (b) increased dry-matter yields of barley by 5·5% after 14 days growth, but did not increase grain or straw yields. —r.b.

1429 Fitzgerald, P. H. **The X-ray sensitivity of *Brassica rapa* L. seeds.** *N.Z. J. agric. Res.* 1959, **2,** No. 6, 1257–61, bibl. 8. [Crop Res. Div. DSIR, Christchurch, N.Z.]

B. rapa seeds were subjected to doses of X-rays from 10,000 to 100,000 r. The higher doses caused a small but significant decrease in seed germination. The survival of plants, 108 days after sowing, from seeds which had received the highest dose was approximately 15% of the survival of the control plants. F. s.—m.h.

1430 Romney, E. M. and others. **Some environmental factors influencing radiostrontium uptake by plants.** *Plant and Soil* 1960,

12, No. 1, 41–8, bibl. 18. [Univ. California, Los Angeles]

A number of crop plants were grown in loam containing ^{90}Sr giving 4120 counts/sec./g dry soil. Millet [sp. not given] contained most ^{90}Sr per unit dry weight of mature tops, followed by Ladino clover, soyabeans, barley, oats and wheat. White Rose potato tubers grown in 3 soils containing ^{90}Sr at 128 counts/sec./g dry soil contained only 2% as much ^{90}Sr per unit weight as did the haulms. ^{90}Sr uptake by potatoes was inversely correlated with the amount of available Ca in the soil. Barley and bean plants grown in nutrient solution absorbed significantly less ^{90}Sr within 24 hr. at root temperatures of 7°C. than at root temperatures of 17°C. Q10 values for this trial were 3·2 and 2·2, respectively, indicating that ^{90}Sr uptake was chemically controlled. Decreasing the light intensity from 1000 to 450 f.c. significantly reduced ^{90}Sr uptake. Where barley and beans were grown for 24 hr. and given 24, 16, 12, 8 or 0 hr. light, ^{90}Sr uptake was reduced as the period of exposure to light was decreased. Between 33 and 50% of the total absorption of ^{90}Sr during 24 hr. was absorbed independently of exposure to light. —R.B.

1431† OEEC. **Application of atomic science in agriculture and food. Vol. 2. Present position, future trends and techniques.** *Proj. 396 OEEC* 1959, pp. 247, bibl. 91, illus.

[For Vol. 1 see *Fld Crop Abstr.* 11 : 1236.] This volume comprises the report and papers of a European Conference held in Paris in 1958. The purpose of the conference was to review the present stage of development in the application of atomic science to agriculture and food in Europe and the USA, including its economic implications for soil and plant science, and food preservation. F. preface.—E.B.O.

1432† Ouang, T. Y. **Recent studies on the application of atomic energy in agriculture.** [Chinese] *J. agric. Assoc. China* 1959, No. 27, 13–18, bibl. 23, English summary. [Taiwan Provincial College of Agriculture]

The subject is discussed under 3 headings : improvement of plant varieties ; control of plant growth (regeneration, germination, yield increases) ; and food preservation. F. Eng. s.—D.B.

MISCELLANEOUS

1433 Reddy, B. R. **The germination of vegetable and field crop seeds as affected by two soil fumigants.** *Diss. Abstr.* 1959, **20**, No. 3, 843. [Univ. Florida, Gainesville]

In studies on the effect of D-D (dichloropropene-dichloropropane) mixture and Dowfume W-40 (ethylene dibromide), the germination of most species tested was inhibited in the presence of either fumigant. A high moisture content in seeds reduced their germination when fumigated, and the phytotoxic effects of the fumigants increased as humidity and temperature increased. In all cases, D-D reduced seed germination more than Dowfume W-40.—P.J.B.

1434 Herford, G. V. B. **Effects of insecticides on seed germination.** *Ann. Rep. Pest Infest. Res. Bd 1958* 1959, 21–2. [Pest Infest. Lab., Slough]

Applications of up to 100 ppm. DDT or 40 ppm. lindane applied to seed of beans (type not given), maize, rice and groundnuts following storage for 18 months did not affect germination.—S.M.J.

1435 Silva, H. L. Nomes vulgares de algumas plantas de São Tomé e Príncipe. (Com notas sobre a origem dos nomes e a utilidade das plantas). [**Popular names of some plants of the islands of São Tomé and Príncipe (Portuguese West Africa). (With notes on the origin of the names and uses of the plants).**] *Garcia de Orta, Lisboa* 1959, **7**, No. 2, 293–323, bibl. 39, English summary.

Among the species considered are : *Colocasia esculenta, Xanthosoma sagittifolium, Vicia faba, Dioscorea alata, D. cayenensis, Zea mays* and *Sorghum arundinaceum*.—E.B.O.

1436† Becherer, A. Fortschritte in der Systematik und Floristik der Schweizerflora (Gefässpflanzen) in den Jahren 1956 and 1957. [**Progress in systematics and floristics of the Swiss flora (vascular plants) in 1956 and 1957).**] *Ber. schweiz. bot. Ges.* 1958, **68**, 197–238.

This biennial report covers the findings of the years 1956–7. It gives for individual vascular plants, new papers on their systematics and noteworthy new locations with any comments by the reporters. The list contains many species of grasses, legumes, forbs and weeds.—D.B.

WEEDS AND WEED CONTROL

1437† Kommedahl, T. and others. **The effects of quackgrass on germination and seedling development of certain crop plants.** *Weeds* 1959, **7**, No. 1, 1–12, bibl. 15, illus. [Univ. Minnesota, Saint Paul]

Stunting and chlorosis were observed in seedlings of wheat, oats, barley, flax and lucerne growing in the field in soil previously occupied by living *Agropyron repens* plants. In the glasshouse the growth of lucerne was retarded when ground

rhizomes of couch, or water extracts from them, were added to soil in pots. Rhizome extracts inhibited the growth of lucerne seedlings. Similar results were obtained in the glasshouse with wheat and oat seedlings ; when these were grown in soil to which leachates of ground rhizomes had been added before autoclaving, their growth was still inhibited. Water extracts from the leaves of couch also inhibited the growth of wheat seedlings.—J.D.J.

1438† Cyr, J.-G. Le chiendent du Québec. [**Couch grass in Quebec.**] *Rev. d'Oka* 1959, **33**, No. 5, 140–4.

A key is given to the taxonomic varieties of *Agropyron repens* and *A. trachycaulum*. The merits and demerits of *A. repens*, its mode of dispersal, and regulations concerning its presence in commercial seed samples are noted.—R.B.

1439 Hay, J. R. and Cumming, B. G. **A method for inducing dormancy in wild oats.** (*Avena fatua* **L.**). *Weeds* 1959, **7**, No. 1, 34–40, bibl. 18. [Canada Dep. Agric., Ottawa, Ontario]

A method is described by which a secondary dormancy was induced in non-dormant seed of wild oats by immersing it in water. This induced dormancy was similar to natural dormancy in all the respects tested. The seed was still viable, since it germinated when the seed coat was punctured. —J.D.J.

1440 Carder, A. C. **Selective control of wild oats in grain crops by use of maleic hydrazide.** *Weeds* 1959, **7**, No. 2, 141–52, bibl. 15. [Exp. Farms Service, Ottawa, Canada]

MH at 8 oz./acre reduced the germination capacity of wild oat seed to less than 5% when it was applied to the parent plant at the milk stage, but timing was critical to within as little as 3 days. Good control of wild oats in barley could be achieved because their phasic development was well separated in time. The same was true of oilseed flax to some extent, but not of wheat or cultivated oats. The yields and quality of the crops were not affected when MH was applied after they had reached the dough stage, but seed germination was impaired in some cases. The degree of control of wild oats achieved in the 2 successive years of these trials was not considered sufficient for practical purposes.—J.D.J.

1441 Bachthaler, G. Das Flughaferauftreten in Bayern im Spiegel der Getreidesaatenanerkennung von 1949 bis 1958. [**Occurrence of wild oats in Bavaria as reflected by cereal-seed certification between 1949 and 1958.**] *Bayer. landw. Jahrb.* 1959, **36**, No. 5, 608–22, bibl. 11, illus. [Bayer. Landesanst. f. PflBau u. PflSchutz, München, W. Germany]

The conditions which encourage infestation of arable crops with *Avena fatua* are briefly reviewed. The decline in the areas under rye and under winter rape has contributed to the increase in the occurrence of *A. fatua*. The economic consequences of infestation of cereal fields with *A. fatua* are reflected in failure to produce certified seed. From statistical records for 1949–58, it emerged that spring cereals suffered most in this respect. Of the total area which failed certification during 1949–58, the percentage attributable to wild oats varied between 20·3 and 67·5 for spring barley, 25·5 and 66 for spring wheat, 18·3 and 57·3 for oats, 3·6 and 51 for winter wheat. Of the weeds and diseases preventing certification, wild oats was the most important single cause. For investigations on wild oats during the period under consideration see *Fld Crop Abstr.* 4 : 830 ; 8 : 1179 ; 10 : 1152 and 11 : 346.—D.B.

1442 Hirdina, F. Beiträge zur Biologie und Bekämpfung des Klettenlabkrautes (*Galium aparine* L.). [**The biology and control of cleavers.**] *Z. Acker- u. PflBau* 1959, **109**, No. 2, 172–94, bibl. 24, English summary.

The effect of temperature, light, soil moisture, depth of seed in soil and soil pH on germination of *Galium aparine* and the effect of crop plants and N fertilizers on its growth were studied in field and laboratory. Seeds lost their viability after 34 days' storage in f.y.m., or 10 days in the decomposition chamber of a bihugas (biological humusgas) installation. Experiments in wheat fields showed that both fine kainite, calcium cyanamide and mixtures of these killed about 90% of plants of *G. aparine* within 5 days. While calcium cyanamide was effective only from the cotyledon- to small-rosette-stage, fine kainite could be applied up to the 6th leaf-whorl stage. Almost 100% control was obtained by spraying with 1% raphatox (DNC), the best stage being the 3–6 leaf-whorl, at which time the cereal is usually 10–15 cm high. In fields of maize, flax and peas, which are sensitive to raphatox, its concentration must be reduced to 0·5–0·75%.—D.B.

1443† Diercks, R. and Junker, H. Fortschritte in der Technik der Ampferbekämpfung. [**Progress in the technique of controlling broad-leaved dock.**] *Prakt. Bl. PflBau* 1959, **54**, No. 3, 81–107, bibl. 5, illus.

One spraying of each individual plant of *Rumex obtusifolius* with at least 65 ml of an MCPP formulation killed 90% of the plants. Manner of application was more important than the growth substance used. This should be applied through a special nozzle which directs a narrow jet of spray on to the growing points of the shoot and the crown of the root. The time used per plant in this intensive treatment was one-fifth that required when spraying the whole field 2–3 times.—D.B.

1444 Palmer, R. D. and Porter, W. K. **The metabolism of nut grass (*Cyperus rotundus* L.). 1. The influence of various oxygen and carbon dioxide levels upon germination and respiration.** *Weeds*, 1959, **7**, No. 4, 481–9, bibl. 13. [Louisiana State Univ., Baton Rouge]

After exposure for 17 days to atmospheres containing 1% CO_2 and 1, 10 or 20% O_2, the germination of single, dormant *C. rotundus* tubers was 34, 70 and 77%, respectively. In atmospheres containing 15% CO_2 and 1, 10 or 20% O_2, germination was 17, 60 and 83%, respectively. In atmospheres of 100% O_2, 95% of tubers germinated. High O_2 concentrations tended to eliminate dominance phenomena in chains of 3 or 5 tubers. At low O_2 concentrations, a proportion of the tubers in given tuber chains germinated and there was evidence that the germinated tubers suppressed germination in dormant tubers. Data are given of tuber respiration at different levels of O_2 in the atmosphere.—P.J.B.

1445 Palmer, R. D. and Porter, W. K. **The metabolism of nut grass (*Cyperus rotundus* L.). 2. The respiratory quotient and its relation to storage materials and some terminal enzymes.** *Weeds* 1959, **7**, No. 4, 490–503, bibl. 16. [Louisiana State Univ., Baton Rouge]

1446 Palmer, R. D. and Porter, W. K. **The metabolism of nut grass (*Cyperus rotundus* L.). 3. Polyphenoloxidase in the dormant tuber.** *Weeds* 1959, **7**, No. 4, 504–10, bibl. 10.

1447 Palmer, R. D. and Porter, W. K. **The metabolism of nut grass (*Cyperus rotundus* L.). 4. The activities of certain enzymes from tubers treated with amitrol.** *Weeds* 1959, **7**, No. 4, 511–7, bibl. 9. [Louisiana State Univ., Baton Rouge]

1448 Oyer, E. B. and others. **The seasonal development of Johnson grass plants.** *Weeds* 1959, **7**, No. 1, 13–19, bibl. 5, illus. [Purdue Univ., Lafayette, Indiana]

A short history of Johnson grass (*Sorghum halepense*) since its introduction into S. Carolina from the Mediterranean region in 1830 is given, followed by a detailed account of the development of plants from seed, from rhizomes, and from buried crowns of seedlings. Seedling plants should be controlled before the 7-leaf stage, at which rhizome formation begins. Covering with soil by cultivation is not always effective. There is scope for the use of pre-emergence or contact herbicides.—J.D.J.

1449 Hauser, E. W. and Thompson, J. T. **A study of the absorption and translocation of several chemicals in Johnson grass, and an evaluation of their effectiveness for its control under field conditions.** *Weeds* 1959, **7**, No. 1, 20–33, bibl. 9. [Georgia Exp. Sta., Experiment]

In pot tests in a glasshouse, herbicidal absorption by *Sorghum halepense* was assessed by the growth of the foliage after it had been sprayed, and translocation assessed by the growth of new shoots from rhizomes. Of several herbicides studied, the Na salt of dalapon was the most consistently and effectively translocated from the foliage to the rhizomes of *S. halepense*. Translocation was not affected by changes in soil moisture, sunlight, or the amount of wetting agent in the spray. Penetration occurred mainly in the first hour after treatment. Absorption was decreased by increasing the pH of the spray, but was not affected by darkness before treatment, or cooling after treatment. In the field, the best results were obtained on fallow areas by 2 applications in spring each of 5 lb./ac., spaced 7–10 days apart, or a single application of 15–20 lb./ac., and on cropped areas by a single application of 15 lb. ac., 1 or 2 months before sowing. Higher rates caused marked necrosis in *S. halepense* and reduced the efficiency of translocation.—J.D.J.

1450 Burt, E. O. **The control of Johnson-grass (*Sorghum halepense* L. Pers.) by herbicides and cultural practices.** *Diss. Abstr.* 1959, **20**, No. 2, 438–40. [Ohio State Univ., Columbus]

Freshly harvested seed of *S. halepense* had average germination percentages of 26–49 after storage in soil in pots. Best control with ploughing alone was secured where this was done as soon as possible after 1 June. Where the soil was tilled after ploughing so as to prevent the production of more than 8–10 in. of top-growth, 84% control of *S. halepense* was obtained. Ploughing before applying herbicides consistently gave better control than where the soil was not ploughed. The minimum rate of application of TCA was 40 lb./ac. and of sodium chlorate 100 lb./ac., when used for summer and autumn treatments. Where *S. halepense* had not been weakened by mowing or grazing before treatment, or where no ploughing had been done, higher herbicidal rates than these were required. Herbicidal applications in September were more effective than those in October or November. Applications of TCA at 20 lb./ac. in March were effective for controlling growth of *S. halepense* from rhizomes and permitted a maize crop to be sown 60 days later. Best effect against rhizomes was obtained where rain leached the herbicides into the soil and so into contact with the rhizomes. Applications of MH at 12 lb./ac. to young foliage of *S.*

halepense, followed by ploughing 3 days after treatment, resulted in 83% control. Pre-emergence applications of 2 or 4 lb. 2,4-D/ac. to maize gave 64 and 83% control of *S. halepense*, respectively, with no injury to the maize.—P.J.B.

1451 Watson, K. A. **Herbicide trials on *Cynodon dactylon*.** *Pest Abstr.* (*C*) 1959, **5**, No. 4, 148–53, bibl. 6. [Reg. Res. Sta., Samaru, Zaria, N. Nigeria]

In 1957, dalapon, MH, TCA and PCP were applied 24 days before sowing cotton. Dalapon gave effective control of *C. dactylon* and the cotton was not injured. In 1958, dalapon and amino triazole were applied to cotton with a Chesterford logarithmic sprayer 30 days before sowing. The effect of amino triazole was transitory, but dalapon was effective at dosages down to 5 lb./ac. and the cotton was not harmed. A field trial with dalapon applied at 10 lb./ac. 26 days before sowing cotton, confirmed this result.—J.D.J.

1452 Friesen, H. A. and Forsberg, D. E. **Neburon as a selective herbicide for tartary buckwheat and wild buckwheat.** *Weeds*, 1959, **7**, No. 1, 47–54, bibl. 9, illus. [Exp. Fm, Scott, Saskatchewan]

Post-emergence sprays of neburon at 3–4 lb./ac. gave complete kill of tartary buckwheat (*Fagopyrum tataricum*) and wild buckwheat (*Polygonum convolvulus*) without damaging wheat, oats or barley, when applied at the 6-leaf stage of the weed and grain. Mixtures of neburon with 2,4-D, at 5 oz., or with MCPA at 6 oz./ac., had a more rapid action and afforded better control of other weeds. Neburon, in the form of an 18·5% wettable powder requiring 100 gal. spray-volume/ac. for uniform application, is regarded as unsuited for use in W. Canada.—J.D.J.

1453† Department of Agriculture, Zanzibar. **Biological control of Lantana.** *E. Afr. Fmr and Planter* 1959, **4**, No. 3, 25.

In Zanzibar, introductions of *Teleonemia scrupulosa* completely defoliated *Lantana camara* and spread slowly into areas adjacent to those into which it was introduced. Where *L. camara* was killed, the area was rapidly recolonized by *Panicum trichocladum*.—S.M.J.

1454† Australasian Irrigator. **Helicopter sprays weeds in difficult country.** *Australas. Irrig.* 1959, **4**, No. 12, 23.

Helicopters have been used successfully to spray weeds on the N. coast of New South Wales in areas where other methods are impracticable. This has given good control of lantana [*Lantana camara*], and of groundsel bush [*Baccharis halimifolia*] under a 20 ft. canopy of ti-trees [*Melaleuca* sp.].—J.D.J.

1455 Edwards, Miriam M. **The germination of charlock seeds.** *Rep. Nottingham Univ. Sch. Agric. 1958*. Sutton Bonington 1959, 36–8, bibl. 2.

Charlock seed remains dormant until at least the second or third season after it is produced, but it will germinate at once if the seed coat is removed. It was shown that at partial pressures of O_2 below 12% within the seed, an unknown inhibitor restricted growth. When seed was buried in the soil the permeability of the seed coat slowly increased, until the critical figure for O_2 was exceeded if the seed was brought near to the surface by cultivation.—J.D.J.

1456 Witts, K. J. **The germination of *Polygonum* species in the field and in the glass-house.** *J. Ecol.* 1960, **48**, No. 1, 215–17, bibl. 2. [Rothamsted Exp. Sta., Harpenden, Herts]

The object of this work was to compare *P. persicaria*, *P. aviculare* and *P. convolvulus* is regard to their times and percentage of germination in soils under field and glasshouse conditions. The greater abundance of *P. persicaria* in all the soil samples may be explained by its ability to continue germination into the summer after a herbicide applied in May of the 2 previous years had destroyed all seedlings that had appeared by that date. The percentage germination of each species was greater in the glasshouse than in the field, but their times of germination were similar under both conditions. F. S.—M.H.

1457 Steinbauer, G. P. and Grigsby, B. **Methods of obtaining field and laboratory germination of seeds of bindweeds, lady's thumb and velvet leaf.** *Weeds* 1959, **7**, No. 1, 41–6, bibl. 5, illus. [Michigan State Univ., East Lansing]

To assist experimental procedures, directions are given for inducing germination in seeds of *Convolvulus arvensis* and *C. sepium*, lady's thumb (*Polygonum* spp.) and *Abutilon theophrasti*, using various combinations of H_2SO_4 treatment, prechilling, and moistening with water or 0·2% KNO_3.—J.D.J.

1458 Klingman, G. C. **Wild garlic bulblet viability determined by 2,3,5-triphenyltetrazolium chloride.** *Weeds* 1959, **7**, No. 4, 474–80, bibl. 5. [North Carolina State College, Raleigh]

Tests showed that large and small garlic (*Allium vineale*) bulblets were equally viable when fresh, but that large ones retained their viability in storage better. Similarly, bulblets with cracked husks, or devoid of husk, were viable when fresh, but deteriorated more rapidly in storage than in-

tact ones. Germination of 78% was obtained from material officially classed as inert. The tetrazolium method was a rapid and reliable test of viability and is advocated as being superior to the official test.—J.D.J.

1459 Estación Experimental Agropecuaria de Pergamino. La maleza en la región pampeana. Memoria de la reunión celebrada en Rosario y Oliveros, 9–10 Noviembre de 1955. **[Weeds in La Pampa region (Argentina). Report of a meeting held in Rosario and Oliveros, 9-10 Nov. 1955.]** 1959, pp. 90, 1 map.

The papers contained in this report are concerned with the following aspects, amongst others : geographical distribution of weeds in La Pampa region ; weeds of groundnuts in Córdoba; common weeds of rice in the Mesopotamia ; weeds in the south of Santa Fé and in the central semi-arid region ; use of selective herbicides for controlling weeds in flax, wheat, maize, rice, sorghum and potatoes ; control of *Sorghum halepense*, *Cynodon* spp., *Cyperus rotundus*, *Artemisia verlotorum*, *Wedelia glauca*, *Convolvulus arvensis*, *Ambrosia tenuifolia*, *Datura ferox*, *Xanthium* spp., *Centaurea* spp., *Salsola kali* var. *tragus*, *Kochia scoparia* and *Melilotus indica*.—E.B.O.

1460† Planters' Bulletin. **Control of weeds on Malayan rubber estates.** *R.R.I. Plant. Bull. 44* 1959, 100–16, bibl. 9, illus.

This article summarizes recent developments on the use of herbicides in Malaya and on their application to particular weeds, including lalang (*Imperata cylindrica*) and other grasses, *Mikania scandens*, Siam weed (*Eupatorium odoratum*), Straits rhododendron (*Melastoma polyanthum*), Maidenhair creeper (*Lygodium flexuosum*), *Mimosa* spp. and bracken (*Gleichenia linearis*).—E.B.O.

1461† Kirinde, S. T. W. **Weed control problems in the dry zone.** *Trop. Agriculturist* 1958, **114**, No. 3, 175–82, bibl. 2. [Dry Zone Res. Sta., Maha Illuppallama, Ceylon] [Received Feb., 1960]

Grasses predominate in the weed flora of the highland zone of Ceylon and *Cynodon dactylon* is especially troublesome. Crops in this zone are normally sown at the onset of rains in October and herbicides are not applied before this time. Pre-emergence treatments with PCP (2 gal. of 1·2% formulation/ac.) or dinoseb (1 gal. of 1·7% formulation/ac.), combined with at least 2 mechanical weedings, have so far proved the most effective of the treatments tested.—P.J.B.

1462† Holmgren, A. H. **Weeds of Utah.** *Special Rep. 12 Utah agric. Exp. Sta.* 1958, pp. 85, illus.

Descriptions are given of 201 species of weeds, 164 of which are illustrated. Typical habitats for these weeds are described.—R.B.

1463† Wurgler, W. La destruction des mauvaises herbes dans les cultures. **[Destruction of weeds in crops.]** *Rev. rom. Agric.* 1960, **16**, No. 2, 9–24, bibl. 21, illus. [Stats féd. d'essais agric., Lausanne, Switzerland]

This review provides a guide to the herbicides authorized for sale in Switzerland and gives a description of individual herbicides, which are classified according to their mode of action. Their application to cereals, maize and root crops, and their use in killing specific weeds of grasslands are discussed.—D.B.

1464 Hattingh, E. R. **Weed problems and present control practices in South Africa.** *Proc. Afr. Weed Contr. Conf., S. Rhodesia July 1958* [n.d.], 118–31, bibl. 22.

1465 Wilson-Jones, K. **Studies on the weed population of the Sudan Gezira Scheme.** *Proc. Afr. Weed Contr. Conf., S. Rhodesia July 1958* [n.d.], 220–9, bibl. 4.

The weed vegetation of the Sudan Gezira Scheme is described in relation to geography, rainfall, cropping and weed control by mechanical and chemical means on fallow land.—S.M.J.

1466† Idrobo, M. E. A. Represión de malezas en zanjas y canales de riego mediante herbicidas. **[Control of weeds in irrigation canals and ditches by means of herbicides.]** *Acta agron., Palmira* 1958, **8**, No. 4, 181–96, bibl. 11, English summary. [Granja Agríc. Exp., Palmira, Cauca Valley, Colombia] [Received Dec., 1959]

An account is given of trials to test several chemical herbicides for the control of the following weeds in canals and ditches : *Panicum purpurascens*, *Cynodon dactylon*, *Portulaca oleracea*, *Solanum nigrum americanum*, *Amaranthus dubius*, *Bidens pilosa*, *Tagetes* sp., *Senecio* sp. and *Cyperus rotundus*. The treatments which controlled these weeds in the dry season were : (a) a mixute of TCA and 2,4,5-T at 15 and 25 kg, or 35 and 50 kg/ha, respectively ; (b) a mixture of CMU and 2,4,5-T at 45 and 30 kg/ha, respectively. The treatments which gave complete control during the rainy season were : (1) CMU at 50 or 70 kg/ha ; (2) mixture (b) above ; (3) a mixture of CMU and TCA at 20 and 40 kg/ha, respectively ; and (4) mixture (a) above.—E.B.O.

1467† World Crops. **Cleaning choked [drainage] channels.** *World Crops* 1960, **12**, No. 4, 156–7, illus.

Dowpon [85% Na dalapon], applied to drainage channels in Kent pastures at 20–40 lb./ac. killed *Phragmites communis*, *Typha* spp. and *Juncus*

articulatus within 23 days of application. Dead foliage was then burnt off.—S.M.J.

1468† Pearce, G. A. **Weed research. 6. Weed control in channels** *J. Dep. Agric. W. Aust.* 1959, **8,** No. 6, 729–34, bibl. 1, illus.

Herbicidal applications to control weed growth in water channels should be made after necessary mechanical work has been carried out, and preferably in late spring or summer when the water level is low. Dalapon may be used for controlling annual and perennial grasses and amitrol for broad-leaved weeds and grasses (recommended applications are given). 2,4-D (ester) at 8 lb. a.e. in 200 gal. water/ac. is recommended for controlling cumbungi [*Typha* sp.] ; at 4 lb. a.e. in 150 gal. water/ac. for *Cyperus eragrostis* ; at 6 lb. a.e. in 200 gal. water/ac. for controlling *Juncus pauciflorus*. Where regrowth occurs, a second application of herbicide should be made.—S.M.J.

1469 Cords, H. P. **The effects of irrigation on the toxicity of 2,4-D and IPC applied pre-emergence.** *Diss. Abstr.* 1959, **20,** No. 2, 442–6, bibl. 3, illus. [Ohio State Univ., Columbus]

The results are given of trials during 2 years in Arizona on the use of irrigation as a means of producing optimum moisture conditions for successful pre-emergence herbicidal treatment. Barley and safflower (*Carthamus tinctorius*) were used as test crops. 2,4-D at 3 lb./ac. followed by irrigation almost eliminated stands of safflower and reduced those of barley. Propham at 3 lb./ac. followed by irrigation reduced barley stands by 50–75% and those of safflower by 0–50%. It was concluded that the use of irrigation to provide optimum soil-moisture conditions for pre-emergence herbicides was feasible only in the case of crops which can tolerate the herbicide used, and where the uniform application of small amounts of irrigation water is possible (as with sprinkler irrigation). The results are given of histological studies on the effect of 2,4-D and IPC on barley and safflower.—P.J.B.

1470 Department of Agriculture, British Guiana. [**Weed control using dalapon.**] *Rep. Dir. Agric. Brit. Guiana 1958* [n.d.], 20.

Two or 3 applications, at 10-day intervals, of dalapon at 2 lb./ac. in 20 gal. water controlled grass and sedge cheaply and effectively, and also killed volunteer rice where the ground was free from water. Dalapon effectively controlled *Echinochloa colonum* without damaging seedling jute. —J.D.J.

1471 Sheets, T. J. **The comparative toxicities of monuron and simazin in soil.** *Weeds* 1959, **7,** No. 2, 189–94, bibl. 8. [Univ. California, Davis]

Simazin was more toxic to oats than monuron, both in culture solutions and in 2 contrasting soil types. In culture solutions, both were equally toxic to soyabeans, but simazin was again more toxic in the 2 soils. Monuron was inactivated more rapidly in soil than simazin, and, as the 2 herbicides were leached at equal rates, the residual hazard from simazin was the greater.—J.D.J.

1472† Datta, S. C. and Dunn, S. **Effects of light quality on herbicide toxicity to plants.** *Weeds* 1959, **7,** No. 1, 55–65, bibl. 8. [Univ. New Hampshire, Durham]

1473† Currier, H. B. and Dybing, C. D. **Foliar penetration of herbicides—review and present status.** *Weeds* 1959, **7,** No. 2, 195–213, bibl. 182. [Univ. California, Davis]

A review is given of present knowledge of the initial pathways by which herbicides enter plants, movement of herbicides in the leaf, and factors influencing these processes. It is noted that penetration from cuticle to phloem in leaves may take longer than translocation from leaf to root. Aspects of the problem which require study are listed.—J.D.J.

SURVEYS AND LAND USE

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1474† Langdale-Brown, I. **The vegetation of the Eastern Province of Uganda.** *Mem. Res. Div. Dep. Agric. Uganda Protect., Ser. 2: Vegetation* No. 1, pp. 154, bibl. 70, maps 7. [Kawanda Res. Sta., Kampala]

This survey is concerned primarily with the savanna vegetation of the Eastern Province of Uganda, an area of 15,233 sq. miles. Fifty-eight communities are distinguished on successional and floristic criteria. The composition, physiognomy, successional status, environment and present land use of each is discussed, maps of their distribution are given and their successional relationships are outlined in 9 diagrams. Small-scale maps of land-use, cultivation density, natural climax types and physiological potential illustrate the connections between current agricultural practice, vegetation and agricultural potential. F.s. —S.M.J.

1475 Langdale-Brown, I. **The vegetation of Buganda.** *Mem. Res. Div. Dep. Agric., Uganda Protect. Ser. 2 : Vegetation.* No. 2, pp. 90, bibl. 66, maps 9. [Kawanda Res. Sta., Kampala]

The findings of the second part of the Ecological Survey of the Vegetation of Uganda are reported. Maps are given of land use, cultivation density, natural climax types, physiological potential, volunteer pastures and physiognomy, in order to illustrate ecological relationships and emphasise the connections between current agricultural practices, the vegetation and the agricultural potential of the region. F. s.—S.M.J.

1476 SETH, G. R. and others. **A survey of agronomic research programmes in India.** *Indian J. agric. Res.* 1958, **28**, No. 3, 409–67, 1 map. [Indian Council of Agric. Res., New Delhi]

The survey was conducted in 1953 and covered all agricultural crops. The information, which was summarized, analysed and tabulated, was obtained by questionnaire. It was limited to field experiments wholly or partially concerned with agronomic practices, e.g. rate, type and method of fertilizer application, methods of cultivation, seed rates, spacing, irrigation schedules, rotations, etc., but not varietal trials, plant protection or grazing experiments. A small, but useful section of the survey analyses the defects of experiments.—D.B.

1477† THIRLAWAY, H. I. S. **The results of arid zone research of the Geophysical Institute, Quetta [West Pakistan].** *Arid Zone UNESCO* 1959, No. 4, 8–12, bibl. 5.

Information is given on the environment, ground-water resources and land use in the Quetta and Kalat Divisions of West Pakistan.—E.B.O.

1478† BEST, R. H. **The major land uses of Great Britain.** *Publ. Dep. agric. Econ., Wye Coll., Univ. London* 1959, pp. 113, bibl. in text, illus.

The changes in the major land uses in Great Britain since 1900, including agricultural land use, are described and evaluated.—S.M.J.

1479 BOERENDONK, M. J. Het landgebruik in Mexico. **[Land use in Mexico.]** *Tijdschr. econ. soc. Geogr.* 1959, **50**, Nos. 8–9, 182–94, bibl. 13, Spanish summary.

Climatic conditions in Mexico are described. Agriculture in Mexico is generally extensive as fertilizers are little used and much of the soil has been impoverished through erosion and continuous maize growing. Yields of maize are low, since much of the crop is grown in droughty districts, primitive methods of cultivation are used, crop rotation is not practised and the seed is of poor quality. The crop is grown mainly in the central parts of the country. Wheat is grown principally in the N. and at high altitudes in central Mexico, and yields are low. Rice is grown on a smaller scale than other cereals and most of the crop is exported. Barley and oats are also grown. Chick peas [*Cicer arietinum*] are a widely grown and high-yielding crop. The cultivation of cotton is concentrated largely in the N. and yields under irrigation are extremely high.—R.B.

1480 CREA, V. Lo sviluppo agricolo della Sicilia. **[The agricultural development of Sicily.]** *Ital. agric.* 1960, **97**, No. 3, 235–58, illus.

1481† NOBE, K. C. **An agricultural regions concept for New York State.** *Diss. Abstr.* 1959, **20**, No. 1, 6. [Cornell Univ., Ithaca, New York]

Information is presented on the physical, sociological and economic bases of farming in New York State, as a background to studies of the performance characteristics of farms there.—P.J.B.

1482 DAVIDSON, B. R. and YATES, R. J. **Relationship between population and potential arable land in the African reserves and the European Highlands.** *E. Afr. Econ. Rev.* **6**, No. 2, 133–8, bibl. 10.

1483 CHANG, H. T. **The prospects of augmenting the agricultural production in Taiwan in the next decade and related problems.** [Chinese] *J. agric. Assoc. China* 1959, No. 27, 1–12, English summary. [Pl. Ind. Div., Joint Commiss. Rural Reconstruction]

A review is given of progress during the past 10 years and plans and prospects for future improvement of agricultural production (a) on the plains and (b) on marginal and submarginal lands. The crops discussed include rice, sweet-potato, soyabean, wheat, jute and cassava. F. Eng. s.—D.B.

1484 ORAM, P. A. **Report to the Government of Libya on crop agronomy and improvement in Tripolitania.** *Rep. 1144 FAO/ETAP* 1959, pp. 96.

This report covers a programme for the improvement of crop agronomy and seed production in Tripolitania, developed by the author during 1952–7. It gives information on : climate, land use, availability of water, agriculture, and the results achieved in the improvement of field crops and forage crops. Groundnut trials were carried out. A summary of recommendations is given.—E.B.O.

LAND RECLAMATION

1485 MILLIGAN, P. W. **Fertile acres from barren waste.** *Quart. Rev. N.A.A.S.* 1959, **11**, No. 45, 42–6.

Two hundred acres of Irton Moor, Yorkshire, 600 ft. a.s.l., with a soil pH of 3·8, were brought into cultivation by burning-off the heather and

birch, ploughing, liming, and growing a pioneer crop of rape [*B. napus* ?], ryegrass and yellow turnips [*B. rapa*], followed by oats and then a 3-year ley. Organic matter ploughed-under took more than a year to decompose. Magnesian limestone was recommended for the area in order to avoid Co, Cu and Mg deficiencies induced by overliming. Good yields of oats and seed potatoes were obtained.—J.D.J.

1486† Bogomolov, G. V. **Study and agricultural development of the arid and semi-arid regions of the USSR.** *Arid Zone UNESCO* 1959, No. 4, 4–7.

FARMING SYSTEMS AND PRACTICES

1487† Turck, G. **A guide to irrigation farming.** *Rhod. agric. J.* 1960, **57**, No. 1, 1–45, illus.

This review of the methods and principles of irrigation in Rhodesia includes information on overhead irrigation and flood irrigation.—S.M.J.

1488† McKeag, J. A. **One-ditch irrigation in U.S.A.** *Australas. Irrig.* 1960, **5**, No. 2, 27–8, illus.

The 1-ditch irrigation/drainage system in the Sacramento–San Joaquin Delta area and its advantages are described. After 30 yr. of use there has been no excessive salinity or salt damage to crops, including lucerne.—S.M.J.

1489† Nielsen, A. B. Vanding i landbruget. [**Irrigation in agriculture.**] *Dansk Landbr.* 1960, **79**, No. 1, 13–18.

The availability of water for irrigation in Denmark and techniques for applying it are described. The value of irrigation for increasing the production of dry matter from grass/clover pastures is discussed.—S.M.J.

1490 Granier, J. Contribution agronomique, à l'étude et au fonctionnement du réseau d'irrigation de Gardanne. [**Agronomic contribution to the study and functioning of the irrigation network of Gardanne (South France).**] *Bull. tech. Inform.* 1960, No. 146, 21–9, illus.

The irrigation network of Gardanne, which began functioning in 1956, covers 800 ha. A table shows the number of irrigations given and the amounts of irrigation water consumed in 1958 by the following crops, among others: winter wheat, winter barley, potatoes, beet and maize. These crops were sprinkler-irrigated, with the exception of part of the maize which was irrigated by furrows. —E.B.O.

1491† Vollbrecht, H. A. **Meat packing plant effluent as an irrigation medium.** *Diss. Abstr.* 1959, **20**, No. 3, 824. [Univ. Wisconsin, Madison]

1492 Bolton, E. F. and Aylesworth, J. W. **Effect of tillage traffic on certain physical properties and crop yields on a Brookston clay soil.** *Canad. J. Soil Sci.* 1959, **39**, No. 2, 98–102, bibl. 9. [Canada Dep. Agric., Woodslee, Ontario]

Land previously cropped with arable crops, lucerne or Ky bluegrass [*Poa pratensis*] was given disc-, spring-tine- and spike-toothed-harrow treatments and sown to maize in 1954 or to oats in 1955. Some of the plots were compacted by excessive tractor traffic before sowing under wet conditions in 1954 and both wet and dry conditions in 1955. Soil compaction significantly reduced yields of oats grown on land previously sown to Ky bluegrass and compacted under wet conditions, but had no significant effect in the other treatments.—R.B.

1493† Williams, T. E. **The value of leys in crop rotation.** *Esso Fmr* 1960, **12**, No. 1, 16–18, illus.

The value of legumes in a ley in increasing fertility, as indicated by yields of following crops, is discussed. A 4-yr. lucerne ley cut 3 times annually was followed by higher yields of winter wheat than was a grazed grass/white-clover ley.—S.M.J.

1494† Baker, H. K. **Leys and soil fertility.** *Quart. Rev. NAAS* 1959, **10**, No. 44, 163–6, bibl. 9. [Grassl. Res. Inst., Hurley]

Work published on the manner and extent of the influence of leys on the yields of subsequent crops is summarized. Higher crop yields are obtained after a 3-yr. ley than after a 1-yr. ley. The structure of clay loam soils under arable crops is considered to require more than 50 years under grass to regain the stability found under old permanent grassland. Better yields of potatoes are obtained after leys with a high clover/grass ratio, and this effect may vary according to the clover variety used. The respective effects of different grass species used in leys on subsequent yields of cereal crops may be masked by infestations of stem-boring insects. Increasing applications of nitro-chalk to grazed leys raise the yields of subsequent

crops of wheat and kale, but depress them when applied to grass that is cut and removed. When grass is removed, or a seed crop is taken, liberal dressings of fertilizers do not make good the loss and the land is left in poorer condition than after a grazed ley. Most effects are cumulative and it does not matter whether the final growth of herbage is ploughed-in, grazed, or cut and removed. The effect of a 3- or 4-yr. ley is often largely superficial, so that a single ploughing will bury the resultant well-aggregated and stabilized topsoil and bring to the surface material little affected by the preceding period under grass.—J.D.J.

1495† Charles, A. H. **Interaction between the cover crop and the undersown herbage.** *Rep. Welsh Pl. Breed. Sta., Aberystwyth 1958* 1959, 59–60.

Undersown Italian ryegrass reduced the growth rate of oat shoots and the crude-protein content of oat straw where N fertilizers had been applied, but not in their absence.—J.D.J.

SOIL AND WATER CONSERVATION

1496† Alles, W. S. **Some studies on run-off and infiltration.** *Trop. Agriculturist* 1958, **114,** No. 3, 197–206, bibl. 7, illus. [Dry Zone Res. Sta., Maha Illuppallama, Ceylon] [Received Feb., 1960]

Preliminary work of a quantitative nature on rainfall run-off, infiltration and soil loss is reported. —E.B.O.

1497 Mirchandani, P. M. and Manrai, G. K. **Effect of terracing on upland crops.** *J. Soil Wat. Conserv. India* 1959, **7,** No. 2/3, 73–7, bibl. 3, illus. [Damodan Valley Corporation, Deochanda Exp. Sta., Hazanibagh]

The construction of the level terrace, graded channel terrace (with a 3% gradient) and bench terrace with open ends is described and illustrated. The level terraces were constructed with and without an opening for draining some of the impounded water. The bench terraces were constructed with and without a 3% slope. Gora rice, maize and groundnut were sown at the onset of the monsoon and grown in rotation during a 3-yr. experiment. The 3-yr. average yields of these crops were lowest on the level terrace and highest on the graded channel terrace which is therefore recommended for these upland crops, which respond to good drainage. Bench terraces with a gradient and open ends also provided conditions for good yields. These terraces are preferred by the farmers of this area.—D.B.

1498† Marsh, B. a'B. **Contour banks for filling dams.** *J. Dep. Agric. W. Aust.* 1960, **1,** No. 3, 225–7, illus.

The building of contour banks is described.—S.M.J.

1499† Neal, M. E. B. **Soil erosion by wind and measures for its control.** *Paper read at Meet. agric. Engng Br., FAO Nov. 1959* [Cont. in] *J. Proc. Inst. agric. Engnrs* 1960, **16,** No. 1, 2–12, bibl. 42, illus.

Conditions causing excessive soil erosion by wind and methods for its control by cultivation and management are reviewed. Suitable spp. for reclaiming eroded areas having a humid or subhumid climate are given.—S.M.J.

AGRO-METEOROLOGY AND CLIMATOLOGY

See also Abs. 1555, 1562.

1500† Demortier, G. Existe-t-il un synchronisme entre le recul des banquises polaires et l'extension des zones arides subtropicales ? Application à l'Atlantique Nord et à l'Europe occidentale, d'une part, au Sahara, d'autre part. **[Does a synchronism exist between the recession of the polar ice caps and the extension of the subtropical arid zones ? Application to the north Atlantic and western Europe, on the one hand, and to the Sahara, on the other.]** *Ann. Gembl.* 1960, **66,** No. 1, 49–64, bibl. 4.

A good chronological agreement has been found between the northward recession of the polar ice caps and the formation of a desert in the Sahara. The theory is advanced that the great sea- and air-currents in the north Atlantic have been the connecting agents between these two phenomena.—E.B.O.

1501 Paquet, J. Caractéristiques d'adaptation des blés destinés à la plaine de Limagne.

[Characteristics of the wheat varieties adapted to the Limagne plain (France).] *Ann. Amélior. Pl., Paris* 1959, **9**, No. 3, 421–34, bibl. 25, English, German and Russian summaries. [Centre Rech. Agron. Massif Central, Clermont-Ferrand]

Information is given on climate in the Limagne plain.—E.B.O.

1502 DE NIE, H. J. Vojvodina, de korenschuur van Joegoslavië. **Vojvodina, granary of Yugoslavia.** *Tijdschr. econ. soc. Geogr.* 1959, **50**, Nos. 8–9, 161–9, bibl. 8, maps 5, English summary.

The climatic conditions of the regions of Bačka and Banat, the most southerly part of the Hungarian plain, are described. The most important crops grown are wheat, maize, hemp, sugar-beet, and sunflower. Rye, barley, oats, flax, cotton and turnips are also grown.—R.B.

1503 DEPARTMENT OF AGRICULTURE, BRITISH COLUMBIA. **Climate of British Columbia. Tables of temperatures, precipitation and sunshine. Report for 1958.** 1959, pp. 43. [Met. Branch, Air Serv. Div., Dep. Transport, Gonzales Observatory, Victoria, B.C.]

1504† CHRISTIAN, C. S. **An Arid Zone Research Institute for India.** *Arid Zone UNESCO* 1959, No. 5, 6–9. (CSIRO, Australia)

Information is given on the environment in western Rajasthan, where a Central Arid Zone Research Institute is being established at Jodhpur.—E.B.O.

1505† BATEN, D. W. and others. **Rainfall probabilities in Michigan.** *Quart. Bull. Mich. agric. Exp. Sta.* 1959, **42**, No. 1, 142–5.

Graphs are given showing the probability of receiving given amounts of rainfall during 1-, 2- or 3-week periods in June, July and August in Michigan.—A.M.H.

1506† ROBERTSON, G. W. and HOLMES, R. M. **Freezing temperature probabilities at Ottawa.** *Publ. 1047 Exp. Fms Serv. Canada Dep. Agric.* 1959, pp. 4.

Tables are given indicating the probability of occurrence of temperatures ranging from 20° to 40°F. on or after given dates in spring, or on or before given dates in autumn, at the Central Experimental Farm, Ottawa.—R.B.

1507† MYERS, R. E. and SHAW, R. H. **Estimation of consecutive dry days at Ames and Corydon, Iowa.** *Iowa State J. Sci.* 1959, **34**, No. 1, 1–9, bibl. 5. [Iowa Agric. Exp. Sta., Ames]

The probability of occurrence of periods of dry weather in which less than 0·2 in. rain falls on any one day is given for each week of the year for dry periods ranging from 0 to 95 days. The probability of a single dry day was relatively constant throughout the year, while the probability of an extended period of dry weather showed a pronounced seasonal pattern, with the lowest probability in late spring and the highest in winter.—R.B.

1508† SINHA, K. L. **Incidence of widespread rain in different seasons in the various parts of India and Pakistan.** *Indian J. agric. Sci.* 1958, **28**, No. 3, 359–71, illus.

The terms "rainy day" and "widespread rain" are defined. The distribution of widespread rain over India and Pakistan in winter, pre-monsoon, south-west monsoon, and post-monsoon periods and for the whole year is shown in maps and tables.—D.B.

1509† STALLINGS, J. L. **Indexes of the influence of weather on agricultural output.** *Diss. Abstr.* 1959, **20**, No. 3, 823. [Michigan State Univ., East Lansing]

A description is given of the procedure used for computing indices of the effect of weather on yields of maize, oats, barley, wheat, soyabeans, cotton and tobacco and on certain aggregate measures of agricultural production in the USA.—P.J.B.

1510 ASAMI, K. **Studies on the low productivity of agriculture in south-western Japan. 1. On the relations of productivity and intensity in regional agriculture.** [Japanese] *Bull. Fac. Agric. Miyazaki* 1959, **5**, No. 1, 6–17, bibl. 4, English summary.

The low yields of rice, wheat and other crops in the S.W. region were attributed to bad weather (frequent typhoons, spells of high temperature, heavy rainfall) and saline volcanic soils. Quantitative data show that, of the 10 regions of Japan, Nankai has the least intensive system of growing rice and the lowest productivity per unit of land. F. Eng. s.—D.B.

1511† THOMAS, D. **The assessment of shelter-need upon exposed farm sites.** *Weather* 1959, **14**, No. 12, 375–84, bibl. 9, illus., 4 maps. [Univ. Coll. Wales, Aberystwyth]

An estimation of the degree of exposure of 2 farms near Aberystwyth by measurements of the tattering rates of unhemmed flags is described.—A.M.H.

1512† SHELLARD, H. C. **Averages of accumulated temperature and standard deviation of monthly mean temperature over Britain, 1921-50.** *Prof. Notes 125 Met. Off. Air Minist.* 1959, **8**, No. 5, pp. 30, illus., London: H.M.S.O.

MISCELLANEOUS

1513 Romania, Institute of Agronomy, Jassy. Cincizeci de ani de învătămînt agronomic superior în Iaşi. [**Fifty years of agricultural research in Jassy, 1908-58.**] 1959, pp. 151, bibl. 179, illus., Jassy. [Received Mar. 1960]

1514 Tardieu, M. Les cultures d'appoint dans la zone d'action du CRA de Bambey. [**Secondary crops in the zone of action of the Centre de Recherches Agronomiques, Bambey (Senegal).**] *Bull. agron. Fr. d'out. mer* 1958, No. 17, 5–54, bibl. 37, illus. [Received Jan., 1960]

An account is given of investigations on several plants including : *Phaseolus acutifolius* var. *latifolius*, *Dolichos lablab*, *Vigna sinensis*, *Voandzeia subterranea* and *Manihot utilissima*, which were studied with a view to developing their cultivation in the French Sudan. The growing of secondary crops, in addition to staple crops (cereals and groundnuts) would improve crop rotation, forage production and native diet.—E.B.O.

1515† Chenery, E. M. **Uganda Protectorate, Department of Agriculture. The Research Division, its history, aims and scientific activities. Kawanda Research Station and Serere Experiment Station.** Publ. Uganda Protect. Dep. Agric. [n.d.], pp. 35.

1516 Maheshwari, P. and Tandon, S. L. **Agriculture and economic development in India.** *Econ. Bot.* 1959, **13**, No. 3, 205–42, bibl. 73, illus.

A review is given of the topography and climate of India and some of the problems involved in agricultural production there. The cultivation of rice, wheat, maize, barley, oats (*Avena byzantina*), *Sorghum vulgare*, *Pennisetum typhoideum*, *Eleusine coracana*, *Cicer arietinum*, *Cajanus cajan*, potatoes, cassava, sweet-potatoes, cotton, groundnuts, *Brassica* spp. and *Eruca sativa* for oil, sesame, oil-seed flax, niger seed (*Guizotia abyssinica*), jute and sunnhemp is briefly described and average yields and commonly grown varieties are given.—R.B.

1517 Gooding, C. D. and Long, J. L. **Preliminary investigation into the control of the emu in northern wheatbelt of Western Australia.** *J. Dep. Agric. W. Aust.* 1959, **8**, No. 6, 659–68, bibl. 1, illus.

1518 Lugo-López, M. A. and others. **Response of some tropical soils and crops of Puerto Rico to applications of lime.** *Tech. Pap. 28 Univ. P.R. Agric. Exp. Sta.* 1959, pp. 19, bibl. 31.

Liming of acid soils in Puerto Rico increased yields of maize, cotton and sweet-potatoes, but sorghum responded to applications of lime only where soil acidity was rather high. Liming significantly increased yields of velvet beans [*Stizolobium* sp.], cowpeas [*Vigna sinensis*] and soyabeans grown for green manure. F. s.—R.B.

1519 Boekel, P. De invloed van structuurregelaars op grond en gewas. **The influence of soil conditioners on soil and crop.** *Landbouwk. Tijdschr.* 1959, **71**, No. 17, 529–37, bibl. 9, English summary. [Inst. Bodemvrucht., Groningen, Netherlands]

Of 8 soil conditioners applied to sandy clay soil, krilium merloam (a compound of vinyl acetate and maleic acid), aerotil (polyacrilonitrile) and to a less extent rohagit (methyl acrylate) improved soil structure. Yields of barley and growth of potato haulms were improved by the use of soil conditioners, while yields of potato tubers, sugarbeet and swede turnips were decreased ; soil conditioners had no effect on yields of wheat.—R.B.

1520† OEEC. **Farm records for farm management purposes.** *Doc. Fd Agric. 9 Proj. 395/2 EPA/OEEC* 1959, pp. 85.

1521 Whitrow, Magda [Ed.] **Indexes to theses accepted for higher degrees in the Universities of Great Britain and Ireland. Vol. 7. 1956-57.** 1958, pp. xii + 177, 24 × 15 cm, London : Aslib, 25s.

The following titles are noted : A comparison of respiratory oxidation mechanisms in wheat and barley, (Ward, M. M.) ; Carbon dioxide fixation in barley roots with special reference to its relationship to mineral ion absorption, (Graham, J. S. D.) ; Studies on the occurrence and chemical properties of hormones in maize, (Britton, G.) ; The physiology of nodule development of some Leguminosae, (Pate, J. S.); A critical survey of the literature relating to lodging in cereals, (Sen, K. M.) ; An agronomic study of *Papaver somniferum* L., (Bunting, E. S.) ; Studies of the growth of certain cereals on seedbeds prepared by dry sieving of the soil, (Edwards, R. S.).—S.M.J.

REPORTS

1522† **Great Britain.** Report of the Nottingham University School of Agriculture for 1958. Sutton Bonington, 1959, pp. 68. [Received January, 1960]
See Abstracts 1309, 1455.

1523 **Great Britain.** Annual Report of the Pest Infestation Research Board, 1958. Department of Scientific and Industrial Research, 1959, pp. 55.
See Abstracts 1227, 1434.

1524 **Netherlands.** Commissie ter Bevordering der Suikerbietenteelt in de Noordelijke Provinciën. Rapport over 1958. [Report for 1958 of the Commission for the encouragement of sugar-beet-growing in the Northern Provinces.] *Meded. Inst. rat. Suikerprod.* 1959, **29**, No. 3, 55–118, illus.
See Abstracts 1260, 1261, 1277.

1525 **France.** Institut de Recherches du Coton et des Textiles Exotiques. Activité de l'IRCT 1957. [The work of IRCT during 1957.] *Cot. et Fibr. trop.* 1959, **14**, No. 2, 77–321, illus.
See Abstracts 1360, 1365.

1526† **Spain.** Estación Experimental de Aula Dei. Departamento de mejora. Ensayos 1957–1958. [Improvement Department. Trials in 1957–8.] Zaragoza, [n.d.], pp. 42.
See Abstract 1101.

1527 **Cyprus.** Department of Agriculture. Annual Report on crop husbandry for 1957. [n.d.], pp. 103. [Received Feb., 1959].
This report gives additional information to that contained in the general report for 1957 [See *Fld Crop Abstr.* 12 : 509]. Among the chapter heads are : plant introduction, field crop investigations, and seed production.—E.B.O.

1528† **Cyprus.** Department of Agriculture. Annual Report for the year 1958. Nicosia, 1959, pp. 64.
See Abstracts 1088, 1338.

1529 **Jordan,** Hashemite Kingdom of. 7th Annual Report of the Deir Alla Research Station, 1958, pp. 73. [Received Nov., 1959]
See Abstracts 1053, 1163, 1252, 1361, 1380.

1530 **Aden Protectorate.** Progress reports from experiment stations, season 1958–59. London : Empire Cotton Growing Corporation, 1960, pp. 25.
See Abstracts 1348, 1350.

1531 **Uganda.** Annual Report of the Department of Agriculture 1957. Entebbe, 1959, pp. 56.
See Abstract 1347.

1532† **Tanganyika.** Agricultural Corporation. Report and Accounts for 1957–8. Dar-es-Salaam, 1959, pp. 149.
See Abstracts 1135, 1164, 1219, 1334, 1363, 1369.

1533 **Southern Rhodesia.** Report of the Grasslands Research Station for 1956–7. Marandellas, [n.d.], pp. 63. [Received Nov. 1959]
See Abstracts 1119, 1150.

1534† **Southern Rhodesia.** Proceedings of the African Weed Control Conference, Victoria Falls, Southern Rhodesia. 23–5 July 1958, pp. 282.
See Abstracts, 1117, 1118, 1146, 1171, 1226, 1294, 1464, 1465.

1535 **Zanzibar Protectorate.** Supplement to the Annual Report of the Department of Agriculture, 1958. Results of field experiments, crop and stock records and other statistics. Zanzibar, 1960, pp. 19.
See Abstracts 1200, 1326.

1536 **Sierra Leone.** West African Rice Research Station, Rokupr, Sierra Leone. Annual Report for 1958. London : Crown Agents for Overseas Governments and Administrations, 1959, pp. 31, illus. 1.
See Abstracts 1173, 1191.

1537 **USA.** Florida Agricultural Experiment Stations. Annual Report for the fiscal year ending June 30, 1958. [n.d.], pp. 411.
See Abstracts 1115, 1140, 1201, 1224, 1225, 1366, 1368.

1538 **British Guiana.** Annual Report of the Director of Agriculture, 1958. [n.d.], pp. 55 + v, mimeo.
See Abstracts 1165, 1336, 1470.

1539 **Surinam.** Landbouwproefstation, Suriname. Jaarverslag 1958. [Agricultural Experiment Station, Surinam. Annual Report for 1958.] Paramaribo, 1959, pp. 90.
See Abstracts 1167, 1188, 1222.

1540† **Argentina.** Estación Experimental Agropecuaria de Pergamino. La maleza en la región pampeana. Memoria de la reunión celebrada en Rosario y Oliveros 9–10 de Noviembre de 1955. [Weeds in La Pampa region

(Argentina). Report of a meeting held in Rosario and Oliveros, 9–10 Nov., 1955.] 1959, pp. 90.
See Abstract 1459.

1541† **Malaya, Federation of.** Department of Agriculture. Annual Report for the year 1958. 1959, pp. 98, illus.
See Abstract 1192.

BOOKS

1542 Nagai, I. **Japonica rice—its breeding and culture.** 1959, pp. 843, bibl. 1367, illus., 21·5 × 15 cm, Tokyo : Yokendo Ltd.

Varieties of rice in Japan and Korea belong to the sub-species Japonica, whilst those further south, in Taiwan, south China, India and Java, belong to the sub-species Indica. The content of this book is by no means confined to the former. Of necessity it considers inter-relationships, both within the species *Oryza sativa*, and through the genus as a whole. Climatic range, origin, genetics, breeding, physiology, cultivation and pathology are all dealt with in turn and in considerable detail.

Three of the 12 chapters deal with rice cultivation in the field. Their sequence is from soils and fertilizers, to patterns and methods of cultivation in general, and the story of Japanese rice in particular. The pattern is set historically by relating present practice to human migration in the past, notably the movement from Indo-China to Java in the second century A.D. And it is set geographically by contrasting irrigation in the hills, where gravity does all the work, with polder cultivation in deltas, where pumps must be constantly working to prevent inundation.

In the section on methods, as elsewhere in this book, there is a great wealth of detailed information. On p. 592, for example, there is listed every conceivable combination of rotational system, wet and dry culture, sowing method, harvesting procedure, etc. Such compilations can be immensely valuable ; but it would have helped to cleanse the mental palate if it had also been said, in a few words, which of these various arrangements really work in practice, and which of them account for the big acreages of world rice at the present time.

The story of rice cultivation in Japan starts with the trend of national yield, which shows an average annual increment of 1% over a period of 72 years. It goes on to examine in turn the cultivation of irrigated and upland rice, harvesting, grading, storage, and implements of all kinds. The same wealth of detail is to be found, even down to the time it takes to plant 100 hills, measured to one-tenth of a second. So much painstaking work is a most valuable contribution to world knowledge of the rice crop. But a clearer impression would have been left if some appraisal had been made of which aspects of the research effort contributed most to the crop's advance.

The whole text is in English, following American usage. The number of misprints and minor errors of language is very large, and from time to time the sense is obscured. Surely revision by someone speaking English as mother-tongue would have been worth while ? The reproduction of some of the black and white photographs in the text also falls below accepted standards. There are comprehensive indexes of subjects, scientific names, and authors, and the bibliography appears to be exhaustive. This is a book which should be available in every agricultural reference library. Those who consult it for detailed information about rice are not likely to be disappointed.—J. D. Jameson.

1543† La Porte, J. Semillas y plántulas de la Crucíferas cultivadas en la Argentina. **[Seeds and seedlings of the Cruciferae cultivated in Argentina.]** 1959, pp. 141, bibl. 25, illus., 24 × 15 cm, Buenos Aires : Fac. Agron. y Veter. Univ.

This book is concerned with the botanical identification, by means of their seeds and seedlings, of the Cruciferae of Argentina, including those used for food or forage, industrial crops and weeds. About 50 species of this family are cultivated in Argentina. Keys are given for the identification of genera (24 are mentioned), species and varieties, and descriptions of the plant, seed and seedling are given for each species. Most of the varieties of *Brassica oleracea* and *B. napus* cannot be identified by means of their seeds and seedlings.—E.B. Owen.

1544† Braid, K. W. **Bracken : a review of the literature.** *Mimeo. Publ. 3/1959 Commonw. Bur. Past. Fld Crops* 1959, pp. 69, bibl. 462, Farnham Royal : Commonwealth Agricultural Bureaux, 7s. 6d.

The morphology, ecology, control and chemical composition of bracken (*Pteridium aquilinum*) and its toxicity to stock are reviewed. The use of the fronds as litter and the possible use of the rhizomes as fodder are discussed.—s.m.j.

1545 Council of Scientific and Industrial Research, New Delhi. **The wealth of India. A dictionary of Indian raw materials**

and industrial products. Raw materials. Vol. 5, H-K. 1959. pp. 372, bibl., illus., 28 × 21 cm, New Delhi : Council of Scientific and Industrial Research. [Received April, 1960]

Vol. 5 follows the pattern and maintains the standard of previous volumes (*Field Crop Abstr.* 9 : 305 ; 11 : 1861).—D.B.

1546† WHYTE, R. O. **Crop production and environment.** 2nd edn, 1960, pp. 392, bibl. 622, illus., 22 × 14·5 cm, London : Faber and Faber, 63s.

In this new edition of his book, Dr. Whyte deals almost exclusively with the developments in research which have taken place since 1946 ; a third of the contents is devoted to the basic scientific research, and two-thirds to the greater understanding which is now being gained of the distribution, growth and reproduction, genetical composition and yielding capacity of crop plants throughout the world. An important new chapter is concerned with the equipment currently in use for research and production. The publication was received in the Bureau at the time this issue of *Fld Crop Abstr.* was due in the Press. It will therefore be reviewed in Vol. 13, No. 4.—C.L.S.

1547 CRESCINI, F. L'agronomia generale. [**General agronomy.**] 2nd edn, 1959, pp. 640, bibl., illus., Roma : Ramo Editoriale degli Agricoltori. [Review seen in *Ital. agric.* 1959, Vol. 96, No. 8]

1548† VASILIU, A. Asolamentele raţionale. [**Systematized crop rotations.**] [Romanian] 1959, pp. 201, bibl. 105, 25 × 18 cm, Russian and German summaries. Bucharest : Acad. Romanian Peoples' Republic. 19.10 Lei. [Received March, 1960]

This work comprises 7 chapters in which the following subjects are elaborated : (1) the significance of crop rotations in regard to the interdependence between plant species, soil and climate ; (2) basic principles emerging from studies on the influence of natural factors, an organized economy and cultural measures : (3) agrotechnical principles ; (4) ley rotations ; (5) field rotations without a herbage break, and including irrigation ; (6) fodder-crop rotations, with special regard to the most suitable crops for specific regions ; and (7) special rotations (market-garden crops with herbage plants, green manure crops, and rotations for sandy soils, marsh lands and salt areas). F. Russ. s.—M.H.

1549† FINLAND, NATIONAL ORGANIZATIONS. Maatilatalouden peruskorjaukset vv. 1960–1980. [**Basic technical improvements of farming in Finland, 1960-1980.**] 1959, pp. 384, illus., 15 × 21 cm, Helsinki. [Received April, 1960]

Throughout 1954–9, 4 national bodies in Finland (the Associations of Agriculturists and of Foresters, the Society of Soil and Hydraulic Engineers, and the Union of Land Survey Engineers) drew up schemes for improving the country's farming during the next 20 years. The schemes are described in this publication, which is divided into 7 sections. There is information on general principles of agricultural policy, with details of improvement schemes for 1960–80 concerning land drainage and clearance, fertilizer use, farm building, adjustment of farm areas, and economic aspects. There is also an account of the outstanding problems and the present position of agriculture in Finland, with an analysis of land utilization, the effect of farm mechanization, and costs of the proposed improvement schemes. It is anticipated that the projects would cost about 15,000 million marks p.a. This is contrasted with the 29,000 million marks p.a. spent during 1944–52 on War reparations and 38,000 million on unemployment relief projects in 1957–8.—From an English summary by A. Jäntti.—M.H.

1550† PHILLIPS, J. **Agriculture and ecology in Africa.** 1959, pp. 424, 25 × 15 cm, London : Faber and Faber, Ltd., 63s.

This is a very important book. Professor Phillips has worked in several parts of Africa, he is widely travelled and widely read ; the bibliography contains about 700 references and will be invaluable as a record of scientific work in Africa south of the Sahara.

More than half the book is devoted to the classification of climates, soils and vegetation, and the author has taken much trouble to sort out the names given to plant associations by those who have worked in, or have visited, Africa. Many visitors have been so thrilled with wildest Africa that they have described as " climax ", types of vegetation which longer study would have shown to be seral ; for example, there seems to be no climax montane grassland in equatorial Africa for, where no fire can reach (as on the precipitous Mount Kadam in Uganda), there is no open grassland.

" Africa — a land of samples and mostly pretty poor ones at that ". Professor Phillips quotes this very wise saying of Field Marshal Smuts, and yet he has taken much trouble to describe and map the bioclimatic regions south of the Sahara and to make general descriptions of forest and grassland soils. He refers to the catena concept of the diversity of soils found in close proximity, as shown by the survey at Kongwa ; and yet he makes generalisations about the potentialities of different zones. Generalisations are misleading, and so is the map because it is impossible to give a true picture of Africa on a small scale ; for example, Kenya is shown as more forested than Uganda.

Some people like forests, some prefer grasslands ; Professor Phillips seems to be one of the former. He refers to grassland soils, under the name "savanna", as being usually deficient in organic matter ; often they contain more than the corresponding forest soils. Pastoral peoples in Africa do not value their stock just on numbers, but they regard the animals as individuals ; and none of the stock—cattle, sheep and goats— is " indigenous " to Africa south of the Sahara. There is reference to " edaphic " grasslands due to seasonal flooding, but no reference to some, such as those to the south-west of Lake Victoria, which persist because the soil is too poor for trees to grow.

" Only the fringe of deficiency has been touched." Soil poverty seems the main reason why yields of crops in Africa are usually so much less than those in other continents ; and it may be that deficiencies in minor elements explain some poor responses to ordinary fertilizers. Deficiencies may cause the poor production of much pasturage in equatorial Africa and it is not fair to blame the types of stock which manage to survive.

For those who have lived in Africa, it is comforting to read the long list of diseases which one did not contract, but it is infuriating to read of the £37,000,000 expended on the Groundnut Scheme ; " Haste is waste " is a good chapter heading. The plea for complete ecological study before any development, and for being sure about soils, climate, water supplies and communications, is most important ; and it contrasts with an attitude of 20 years ago : " Where agriculture is highly developed, as in most parts of Uganda, an ecological survey in the usual sense would be mainly of academic interest ".

Everybody concerned with the future of Africa should read this book. The administrators should read the second half ; the scientific workers should also read the first half and should try to remember the meaning of initials like " SDS-SA-OGS-ST/A". And both administrators and workers should remember that it is of no use to preach ecology—it must be practised in " Africa—a land of samples and mostly pretty poor ones at that ".—A. S. Thomas.

1551† Steward, F. C. [Ed.] **Plant Physiology. Vol. 2. Plants in relation to water and solutes.** 1959, pp. 776, bibl., illus., 23 × 15 cm, New York and London, Academic Press, 157s.

This treatise (vol. 2 of which has been published before vol. 1), will be produced in 6 volumes and when complete will cover (a) cell physiology and problems relating to water and solutes, (b) nutrition and metabolism, and (c) growth and development. The present volume deals with the movement of solutes within the plant and the water relations of plants. It consists of 7 related chapters by different contributors as follows : (1) Cell membranes : their resistance to penetration and their capacity for transport, by R. Collander ; (2) Water relations of cells, by T. A. Bennet-Clark ; (3) The water relations of stomatal cells and the mechanisms of stomatal movement, by O. V. S. Heath ; (4) Plants in relation to inorganic salts, by F. C. Steward and J. F. Sutcliffe ; (5) Translocation of organic solutes, by C. A. Swanson ; (6) Translocation of inorganic solutes, by O. Biddulph ; (7) Transpiration and the water economy of plants, by P. J. Kramer. An attempt has been made to achieve a measure of integration between the chapters and these are bridged by a preamble to give continuity. The treatise, which is intended for those working at post-graduate level, will primarily provide a synthesis of current knowledge, but will also consider the significant contributions of the past and give an insight into problems of the future. Each chapter has an extensive bibliography, and the publication is fully indexed according to subject matter, author and plant names. Plant names are taken seriously. Any plant mentioned in the vernacular is identified, wherever possible, by its scientific name the first time it is used in a chapter, particular care being taken to ensure the correct designation of plants mentioned in tables and figures. " . . . the precise identification of plant material used in experimental work is as important for the enduring value of the work as the precise definition of any other variables in the work ".—D. Brown.

1552 Withrow, R. B. [Ed.] **Photoperiodism and related phenomena in plants and animals.** 1959, pp. xvii + 903, bibl. at end of chaps., illus., 23·5 × 15·5 cm, Washington D.C. : Amer. Assoc. Adv. Sci., 133s.

This work embodies the proceedings of an international symposium on photoperiodism held in the USA in 1957 under the sponsorship of the National Academy of Sciences and the National Research Council. Reviews and original research contributions by some 75 authors form the subject matter, which is divided into 11 sections ; 7 of these are relevant to the botanist and here most of the work is with horticultural or uncultivated plants although some reference is made to field crops and herbage plants.

The photochemical analysis of the problems involved, with particular reference to the initial photoreaction, are dealt with in the first section. The photochemical properties of pigments and their action spectra are considered, as is also the energy transfer in photochemical systems.

Two sections follow on the photocontrol of seed germination and vegetative growth, together with the role of chemical agents in this. Reactions of red and far red light are the main concern and, among results presented, exposure to far red light as compared with red light is shown to produce

increased stem elongation in soyabean, millet and beans. The effects of fluorescent and incandescent light are considered in relation to the modulation response of red to far red forms of pigment and, in the case of etiolated peas, the same red – far red reversible photoreaction is shewn to control IAA oxidation. The roles of IAA, kinetin, gibberellic acid, cobalt and adenine, respectively, are dealt with in relation to these red – far red effects on leaf growth, internode elongation and the opening of the hypocotyl hook in peas and beans.

The photoperiodic control of reproduction and the growth factors concerned are covered in Sections 4 and 5. The effect of latitude on the flowering of soyabean is mentioned and the action spectra for flowering of barley and soyabean are compared with each other and in relation to those for seed germination and stem elongation. The dual daylength requirements of winter cereals are discussed and the dark fixation of CO_2 by succulents dealt with. Auxin was shewn to promote flowering in long-day plants, whilst inhibiting short-day plants, whereas gibberellic acid was effective only on long-day plants. Maleic hydrazide, 2,4-D, and dalapon were shewn to be generally inhibitory.

The analysis of plant photoperiodism comprises Section 6. The chemical nature of the induction processes is reviewed and it is suggested that the photoreversibility of the red – far red pigment system controlling photomorphogenic responses is a photohydrogenation, in which the quantum efficiency is determined by the ratios of oxidants and reductants. The plant is also considered in relation to daylength variation and spectral energy, the photoprocesses being related to the action spectra.

In the seventh section the periodicity involved is considered, especially with reference to endogenous rhythms within the plant ; the leaf movements of *Phaseolus multiflorus* form a specific example.

Workers concerned with photoperiodism will find this symposium valuable, although much of the classical work receives only a brief review. It is regrettable that in a symposium of this size so few references are made to herbage and field crop plants, but this omission itself indicates the broad front on which advances are being made in this field. The standard of the papers presented is commensurate with the large number of leading international authorities contributing and this book forms a fitting epitaph to the late Dr. Withrow, himself a great contributor to photoperiodic work.—O. R. Jewiss.

1553† Lavrenko, E. M. and Korčagina, A. A. [Eds] **Field geobotany.** [Russian] 1959, pp. 444, bibls at end of sections, illus., 18 × 27 cm, Moscow/Leningrad : Acad. Sci. USSR, 27 roubles, 80 kopeks. [Received March, 1960]

This is the first of 4 volumes which are to be published in this series between 1959 and 1962. The following main aspects are considered : (1) principles governing plant communities and methods for their study ; (2) natural conditions of plant communities ; (3) methods for ecological and physiological studies of the components in plant communities ; (4) study of the flora ; and (5) cryptogamic components of plant communities. —M.H.

1554† International Potash Institute. **Potassium symposium 1958,** pp. 426, Berne, Switzerland : International Potash Institute. [Received Feb., 1960]

This publication consists of the papers, communications and discussions at the 5th Congress of the International Potash Institute held in Madrid in 1958, when the emphasis was on potash manuring in relation to water problems. There were 4 sessions : (1) manurial problems in Spanish agriculture ; (2) water, potassium and plant ; (3) water, potassium and soil ; (4) potassium in regions having a deficiency or surplus of water. The papers are in either Spanish, French, German or English with summaries in 3 languages. The subject index is in 4 languages.—D.B.

1555† Miller, A. A. and Parry, M. **Everyday meteorology.** 1958, pp. 270, bibl. 17, illus., 28× 14·5 cm, London : Hutchinson, 30s.

In this book the science of the weather and its importance to farmers and the community in general is considered in some detail. Methods for forecasting the weather are given, together with a section on the setting-up of weather stations. Although the book deals mainly with the weather experienced in the British Isles, reference is also made to weather in other parts of the world. The book is well illustrated with diagrams and photographs.—S.M.J.

1556† Frear, D. E. H. [Ed.] **Pesticide handbook 1959.** 11th edn, 1959, pp. 250, 23 × 15 cm, State College, Pa : Coll. Sci. Publishers, $1·75.

The trade names, ingredients, uses and manufacturers of 7041 products are listed, and the compatibilities and toxicities of their active ingredients are given.—R.B.

1557† Haensch, G. and Haberkamp, Gisela. **Dictionary of agriculture. German-English-French-Spanish, systematical and alphabetical.** 1959, pp. xxiv + 649, 22 × 15 cm, London : Crosby Lockwood and Son, Ltd., 85s.

This dictionary contains the principal terms used in agriculture, arranged in 14 main sections.

Within each section, the German words are arranged alphabetically and against each are placed the equivalent words in English, French and Spanish. There are 7401 of these 4-language entries. To assist the user, an alphabetical index in each of the 4 languages is provided.—C.L.S.

NEWS AND NOTES

Great Britain

1558† The filtered effluent from a fruit and vegetable canning factory in Norfolk is being used to irrigate a nearby farm. After leaving the factory the effluent is passed through a coarse screen, then through a tank where rotating nylon brushes remove the smaller solids and finally to a settling tank from which it is drawn as required. *World Crops* 1960, **12**, No. 5.—S.M.J.

1559 A NEW LOW-TOXICITY WEED KILLER, S.847 [4-chloro-2-butynyl-N-(3-chlorophenyl) carbamate], to be marketed under the name of carbyne, [applied at 8·32 oz. a.i./ac.] killed wild oats (*Avena fatua*) in wheat, barley, peas and sugar-beet. *World Crops*, **12**, No. 1.—S.M.J.

1560 THE 5TH BRITISH WEED CONTROL CONFERENCE will take place at Brighton during 7–10 Nov., 1960, and will cover all aspects of weed control. A provisional programme of the Conference is given in *Chem. and Industr.* 14 May, 1960, No. 20.—E.B.O.

Portugal

1561† MAPS. A department, under J. P. M. Albuquerque, of the Estação Agronómica Nacional, Sacavém, is concerned with the delimitation of agricultural zones in Portugal, consideration being given to ecological, human and economic conditions. The work carried out includes the publication of ecological and agricultural-economic maps of the country. [See also *Fld Crop Abstr.* 12 : 477.] *Agricultura, Lisboa* 1959, No. 3.—E.B.O.

Tunisia

1562 RICE GROWN FOR THE FIRST TIME IN TUNISIA. The irrigation project in the Medjerda Valley covers about 50,000 ha, but the irrigation water has a high salt-content (3–4 g/l in summer). Dr. Pan, of FAO, has carried out experiments on 10 ha in the Medjerda area to study the possibility of washing out the salt deposits. "We experimented with ponding the land with 1 ft. of water for 1 or 2 weeks, permitting it to percolate through the soil and then draining it through deep ditches," he stated. "By these means we were able to keep the salinity of the soil below the critical level." The success of this method led Dr. Pan to experiment with the cultivation of rice with promising results. *Publ. FAO 59/11/9041.*—E.B.O.

Kenya

1563† AN INSTITUTE OF TROPICAL METEOROLOGY which will serve all countries in tropical Africa is to be built near Nairobi, at a cost of £40,000, by the American Munitalp Foundation. An important task of the Institute would be to collect and disseminate knowledge of tropical meteorology and its associated subjects, *Commonw. Devel.* 1960, Vol. 7, No. 1.—C.L.S.

South Africa

1564 In 1958 the South African Department of Agriculture was reorganized and divided into the Department of Agricultural Technical Services and the Department of Agricultural Economics, and Marketing. Among the research projects approved by the Department of Technical Services up to July 1959 the following are listed (in Afrikaans) : Retardation of sprouting in potatoes, (P. F. Clarke) ; Mildew on barley (*Erysiphe graminis hordei*), (G. J. M. A. Gorter) ; Trials with pulse crops for hay, (H. C. Hugo) ; The effect of fertilizer placement on cotton yield, (G. J. Kerkhoven) ; The effect of fertilizers on the vitamin and amino-acid content of maize, (G. V. Quicke) ; Chemical control of weeds in *Sorghum vulgare* and wheat, (I. D. Hattingh).—S.M.J.

India

1565 SEA ISLAND COTTON An article in the *Indian Cotton Growing Review* vol. 13, No. 5, Sept, 1959, gives an account of the early attempts (since 1830) to introduce Sea Island cotton into India, the beginning (in May 1957) of the All-India Sea Island Cotton Development Scheme, and the progress to date in the cultivation and processing of this type of cotton. Cotton-seed oil as a byproduct is also discussed.—D.B.

1566 THE INDIAN COUNCIL OF AGRICULTURAL RESEARCH recently published the first issue of the *Indian Potato Journal.* This journal will be published twice yearly and will contain original papers, review articles and news items. From *American Potato Journal* 1959, Vol. 36, No. 11, p. 425.—R.B.

China

1567 CHINESE YAM The following note received recently from the Director of the Royal Botanic Gardens, Kew, is given below because it clears up the nomenclature of this crop. "The yam of China is *Dioscorea batatas* Decne and this is the yam known in Asia as Chinese yam. But I. H. Burkill, whose work on *Dioscorea* we accept as authoritative, prefers to call it *D. opposita* Thunb., regarding this as the prior name for the plant. Burkill's example has not been widely followed as yet, and, if you should use the name *D. opposita* Thunb., it would be well to follow it by (*D. batatas* Decne) so that everyone may know to what you refer. Unfortunately when the lesser yam, *D. esculenta*, was introduced into West Africa, it was planted under the name Chinese yam, so that W. African agricultural reports of the Chinese yam are referable to *D. esculenta* (Lour.) Burkill. This species is not Chinese in origin and the use of the name is incorrect,

confusing, and to be discouraged. Lesser or little yam is both suitable and the name accepted for it elsewhere."—D.B.

Australia

1568† A NEW JOURNAL is to be published quarterly by the Australian Institute of Agricultural Science. It will contain articles on research developments in agriculture and livestock management and is intended for agricultural scientists, farmers and graziers. The project is sponsored by Commonwealth and State Governments and is a result of a recommendation by the Australian Agricultural Council. *Aust. J. Sci.* 1960, **22**, No. 7.—S.M.J.

USA

1569† As a result of the National Defense Education Act in 1958, the Office of Science Information Service (OSIS), was established to replace the former Office of Scientific Information. A Science Information Council to advise and make recommendations to OSIS was established at the same time. Within OSIS the 4 major sections are Documentation Research, Foreign Science Information, Publications and Information Services and Unpublished Research Information. Electronic translators are being developed, mainly for translating Russian texts. A fortnightly journal, *Technical Translations* which contains lists and abstracts of available scientific translations began publication in Jan. 1959. *Nat. Sci. Foundation, 9th Ann. Rep.*, 1959.—S.M.J.

Colombia

1570 AGRICULTURE. A special number of *Agricultura tropical* was issued on the occasion of the " II Congreso Nacional de Ingenieros Agrónomos " which met at Palmira, in Nov., 1959. It illustrates the progress of agriculture in Colombia during 1945–59, a period covered by issues of the journal. *Agric. trop., Bogotá*, 1959, **15**, No. 11.—E.B.O.

Enquiries received

1571 Arising from enquiries received, a memorandum on classification schemes for mangels and fodder-beet was prepared by the Bureau and is available on request from the Director. A bibliography on land reclamation in Gt Britain was also prepared (S.213).